

Rationalization of the Bering Sea and Aleutian Islands crab fisheries

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Abstract

In recent years, overcapacity in Bering Sea and Aleutian Islands crab fisheries has resulted in a dangerous race for crab. This paper examines a unique management program developed by the North Pacific Fishery Management Council intended to alleviate these problems, while accommodating a variety of stakeholders dependent on the fisheries. The discussion concludes by identifying some of the most substantial hurdles that the program must overcome to succeed and some characteristics of the fisheries that contribute to the potential to overcome these obstacles.

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1. Introduction

Since their inception, the Bering Sea and Aleutian Islands crab fisheries have attracted participants willing to undertake great financial and personal risks to participate. Notwithstanding the adoption of measures to limit entry, several fisheries have attracted excess capital and overcapacity resulting in a race for crab. This race has compromised safety and economic returns from the fisheries and complicates management and conservation of the resource. In response to these concerns, the North Pacific Fishery Management Council¹ is in the process of “rationalizing”²

the Bering Sea and Aleutian Islands (BSAI) crab fisheries.³

The Council’s preferred rationalization program reflects its desire to accommodate the interests of several groups dependent on these fisheries—vessel owners, processors, captains and crew, and communities. Under the program, harvest quota shares (QS) will be issued to vessel owners and captains. Processors will be issued processing quota shares. Under these allocations, 90 percent of harvest shares are designated for delivery to holders of processing shares. Community interests are protected through several community protection measures including a regionalization program that requires that a certain portion of the catch be landed and processed in designated regions. An arbitration program is included to resolve price disputes, which could arise because of the constraints on markets created by the dual share allocations. The result of the Council’s action is a complex fishery management program intended to protect the interests of those that depend on these fisheries. The discussion of the crab fishery management program concludes by identifying some of the most substantial hurdles that the program must overcome for the Council to judge it a successful management program for the fisheries. Each of these issues is

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¹The North Pacific Fishery Management Council is one of eight regional councils authorized under the Magnuson Stevens Act to recommend management measures for the fisheries in the US Exclusive Economic Zone from 3 to 200 miles off the US coastline. The North Pacific Council’s jurisdiction is the US federally managed fisheries off the coast of Alaska. The Council is composed of 11 voting members, three from the State of Washington, one from the State of Oregon, and six from the State of Alaska, and the regional director of the National Marine Fisheries Service, the federal agency responsible for the administration of fisheries regulations. See [1].

²“Rationalization” is a frequently used, seldom defined term that describes certain fishery management plans. Generally, the term is used to describe a management plan that results in an allocation of labor and capital between fishing and other industries that maximizes the net value of production [2].

³The section of this paper describing the operational details of the program are based on [3–5]. The author of this paper is a primary author of each of those documents.

Table 1
Bering Sea/Aleutian Islands Crab License Limitation Program licenses by endorsement and vessel type

License endorsement	Fisheries the endorsement applies to	Catcher processor	Catcher vessel	Total
Aleutian Islands brown king	W. Aleutian Islands (Adak) brown king E. Aleutian Island (Dutch Harbor) brown king	9	29	38
Aleutian Islands red king	Western Aleutian Islands (Adak) red king ^a	5	33	38
BSAI opilio/bairdi	Bering Sea <i>C. opilio</i> (snow crab)	27	282	309
Tanner	Bering Sea <i>C. bairdi</i> (Tanner crab)			
Bristol Bay red king	Bristol Bay red king	26	276	302
Pribilof Islands red/blue king	Pribilof blue and red king	3	133	136
St. Matthew blue king	St. Matthew blue king	14	185	199
Total Licenses		27	294	321

Source: [3].

^aThis endorsement also applies to the Western Aleutian Islands (Dutch Harbor) red king crab fishery. The fishery has been closed for approximately 20 years.

described in a manner that provides the reader with a perspective of the institutional challenges faced by a program that attempts to address the concerns of several different interests. In addition, characteristics of the fisheries that contribute to the potential to overcome these obstacles are discussed.

2. The current management problem

The eight major BSAI crab fisheries are currently managed under the License Limitation Program, a limited entry program under which licenses are allocated based on historic participation. Licenses are endorsed for one or more area and species. Table 1 shows the number of licenses in each fishery. Licenses are issued by vessel type, catcher vessel or catcher/processor. Interim licenses are currently subject to adjudication under recent participation requirements. Since licenses can carry multiple area/species endorsements, the total number of licenses is not additive.

Notwithstanding the limit on entry, conditions in the fisheries are symptomatic of substantial overcapacity. The three largest fisheries, the Bristol Bay red king crab, the Bering Sea *C. opilio* (snow crab), and the Bering Sea *C. bairdi* (Tanner crab) fisheries, have received the most fishing effort. Stock declines in the Bristol Bay red king crab and the Bering Sea *C. opilio* have led to short seasons of a few days or weeks, as harvesters race to catch the annual quota.⁴ The Bering Sea *C. bairdi*, St. Matthew blue king crab, Pribilof blue and red king crab fisheries have all been closed the past several seasons due to low resource abundance. When open, these fisheries also received substantial effort, primarily from vessels that also participate in the larger crab fisheries. The Aleutian Islands

golden king crab fisheries have received less effort than most of the other BSAI crab fisheries due to their remote grounds and the need for specialized gear for participation. Participation in these fisheries has increased in recent years and would likely increase further without a change in management. The Western Aleutian Islands (Adak) red king crab fishery has been closed in recent years, but opened in 2002 for a season under a new harvest strategy.⁵ The 2002 season lasted approximately 2 days.

Since these fisheries are currently managed under the License Limitation Program, harvester entry is limited. Individual harvests, however, are determined by a competitive race for crab. Safety can be compromised by the incentive to harvest the high-valued crab more quickly than others. At the extreme, during the 2002 Bristol Bay red king crab fishery season, which lasted only 68 h, fewer than 250 vessels harvested more than 8.5 million pounds of crab. The ex vessel price of crab during the season was approximately \$6.80 per pound. So, the gross revenue of the average vessel was in excess of \$200,000. The fleet harvested over \$750,000 of crab each hour of the season. The race for crab has spillover effects on the processing sector, which is forced to process landings as quickly as possible to minimize deadloss.⁶ Efficiency, quality, and product development are all sacrificed.

Since the seasons in most of the fisheries do not conflict, most participants are active in several of the fisheries, moving from one fishery to another throughout the year. Notwithstanding these opportunistic movements from fishery to fishery, equipment is often

⁴The cause of stock declines is uncertain, but most scientists believe that the declines are caused by environmental regime changes.

⁵Harvest strategies are the rules by which annual allowable harvests are set. Modifying assumptions concerning harvests and bycatch mortality in these models can accommodate some changes in harvest behavior.

⁶Since crab must be processed live to prevent spoilage, deadloss is a concern in these fisheries.

idle for several months of the year. Several participants assert that they are unable to breakeven in the fisheries at current harvest levels.

3. The management challenge facing the Council

The immediate challenge faced by the Council is the race for crab that has developed. Although the Council has already taken the initial step of limiting entry to the fisheries, capacity to harvest crab in the fisheries far exceeds available crab. Declines in the resource, increases in inputs other than vessels, and the liberal allocation of licenses at the onset of the license limitation program all contribute to the overcapacity in the fisheries.⁷ Share-based management (such as individual transferable quotas (ITQs) or individual fishing quotas (IFQs)) are often advocated by economists as a solution to the overcapacity and inefficiency that arise in open access fisheries [6]. Comprehensive ITQ programs in both New Zealand and Iceland have proven successful in achieving substantial efficiency gains in the fisheries in those countries [7–9]. Likewise, IFQ programs in the Alaskan halibut and sablefish fisheries have eliminated a race for fish expanding seasons in those fisheries from a few days a year to a several months a year [10]. IFQ programs, however, have come under criticism because of their distributional impacts. Allocating shares without payment for the resource use is argued to provide a windfall of a public resource to share recipients [11,12].⁸ The change in management regime to an IFQ program is said by others to have detrimental impacts on processors, who are argued to lose negotiating leverage, if harvest shares are allocated only to harvesters [13,14].⁹ Similarly, economists have found some evidence of a shift in market power in the employment market of captains and crew as fleets have contracted under IFQ programs [17]. Communities can also be affected by changes in the geographic distribution of landings that arise under IFQs [9,12,18]. These competing interests complicate efforts to develop an equitable rights-based management program [19].

⁷ Although some inputs are limited, such as the number of pots that may be used and vessel lengths, others such as beam and horsepower are not limited. See [6] for a theoretical discussion of the license limitation and gear restrictions.

⁸ Proponents of charging for share allocations (either through direct landing fees or auctions) might support temporary, cost-free allocations of shares to overcome transitional burdens that arise from the change in management regimes. As these cost free allocations are phased out, shares could be auctioned to compensate the public for the value of the resource use. Share tenure, landing fees, and eligibility criteria for auction participation could all be tailored to achieve social objectives.

⁹ For a critique of the findings of these papers see [15,16].

4. The proposed management program for the crab fisheries

For several years, the North Pacific Fishery Management Council worked with participants in the BSAI crab fisheries through working groups and management measures to address problems that have arisen from the race for fish. In 2000, Congress stepped in, directing the Council to assess various rationalization programs for the fisheries, including IFQs, processor shares, cooperatives, and quotas held by communities.¹⁰ In response, the Council developed a new and unique management program as its preferred alternative for rationalization of the Bering Sea/Aleutian Islands crab fisheries. In January of 2004, Congress directed the Secretary of Commerce to implement the program by January 1, 2005.¹¹ This section describes the program.

4.1. The harvest sector

In each fishery, harvesters would be allocated quota shares (QS), a revocable privilege that allow the holder to receive an annual allocation of a specific portion of the annual total allowable catch (TAC) from a fishery. These annual allocations are referred to as IFQs. QS will be designated as either catcher vessel shares or catcher/processor shares, depending on whether the vessel that created the privilege to the shares processed the qualifying harvests on board.¹² Catcher vessel IFQ would be issued in two classes, Class A shares and Class B shares. Class A shares, which will require delivery of harvests to a processor holding processor quota, will be issued for 90 percent of the catcher vessel allocation in each fishery.¹³ Class B shares, which will permit delivery of harvests to any processor will be issued for the remaining 10 percent of the catcher vessel allocation.¹⁴

¹⁰ This Congressional directive appears in the Consolidated Appropriations Act of 2001, which was passed by Congress in 2000 [20].

¹¹ This Congressional directive appears in the Consolidated Appropriations Act of 2004 [21]. The process by which this program was adopted differs from the typical Council procedure because the Councils are not generally authorized to develop a program with processor shares. The authority for the program was granted only after the Council provided the Congress with an analysis of the program in response to the Congressional request in the Consolidated Appropriations Act of 2001 [20].

¹² Catcher/processors participate in both the harvest and processing sectors and therefore have a unique position in the program. To protect their historic participation, catcher/processors will be allocated catcher/processor QS and IFQs, which will carry both a harvest privilege and an accompanying on-board processing privilege. Catcher/processors will receive less than 10 percent of the allocation in the largest fisheries.

¹³ Class A share landings are not tied to a particular processor, but must be delivered to a processor holding unused processing shares.

¹⁴ The Class A/Class B share distinction would apply only to annual IFQ allocations. So, 90 percent of the IFQ issued would be A shares and 10 percent B shares. By not making an A share/B share distinction

Class B shares are intended to provide harvesters with additional market leverage for negotiating prices for landings of crab. Consequently, Class B shares will be allocated only to harvesters that are unaffiliated with holders of processing shares. This Class A/Class B share division is intended to balance the interests of harvesters and processors.¹⁵

A harvester's allocation of QS for a fishery would be based on historic landings (excluding landings of dead-loss). Specifically, each allocation is the harvester's average annual portion of the total qualified catch during a specific qualifying period, selected to balance historical participation and recent participation. Different periods were selected for different fisheries to accommodate closures and other circumstances in the fisheries. The most recent seasons were excluded in part to limit the effectiveness of efforts by participants to obtain a larger allocation by increasing participation once it was apparent that allocations would be based on historic harvest levels. This speculative activity is a potential problem in fisheries that are transitioning to management programs with share allocations based on historic participation [9]. Table 2 shows a summary of the allocations to harvesters in the different fisheries.

QS and IFQ would both be transferable under the program, subject to limits on the amount of shares a person may own or use. Transferability of shares is necessary to reduce fleet size and remove capital from the fishery, as well as to improve economic efficiency and to aid in coordination of deliveries.¹⁶ Separate caps would be imposed on the ownership of shares by any person and the use of IFQs on any vessel. These caps are intended to prevent excessive consolidation of shares under the program. Limits on consolidation can be used to ensure adequate levels of market competition, facilitate entry to the fishery, protect labor markets, and ensure that the resource supports several participants [9]. Caps differ among the fisheries with fleet characteristics and differences in historic dependency of participants. Vessel use caps would not apply to cooperatives providing an additional incentive for cooperative participation. The ownership and use caps proposed for the different fisheries are also shown in Table 2. Table 2 also shows the estimated number of registered license holders that would be allocated shares

in excess of the applicable ownership caps. Initial allocations of shares above the cap would be grandfathered.

4.2. The processing sector

The program would also allocate to processors a processing privilege, processing quota shares (PQS), that is analogous to the harvest privilege allocated to harvesters. These allocations to processors are intended to protect processor investment in the fisheries and balance the bargaining power of processors with harvesters receiving harvest shares.¹⁷ PQS are a revocable privilege to receive deliveries of a specific portion of the annual TAC from a fishery. These annual allocations of processing privileges are referred to as Individual Processing Quotas (IPQs). IPQs would be issued for 90 percent of the allocated harvests, corresponding to the 90 percent allocation of Class A harvest shares. The remaining 10 percent of processing would be unallocated, and therefore harvesters could deliver those landings to any processor.¹⁸ PQS allocations would be based on processing history during a specified qualifying period for each fishery. A processor's allocation in a fishery would equal its share of all qualified processing in the qualifying period (i.e., pounds processed by the processor divided by pounds processed by all qualified processors). Table 3 shows

¹⁷The effort of the Council to balance the interests of harvesters and processors through the allocation of processing shares is based in part on a theoretical analysis of the Pareto effects of such an allocation [22]. This analysis, however, has drawn criticism of commentators that question its findings and also question whether such a complex system might impede efficiency gains. These critics question whether direct compensation (such as a processing capital buyback) or an allocation of harvest shares to processors could adequately compensate processors without potentially reducing efficiency or competition for landings [15,23], see also [19]. The potential efficiency implications of processor shares, however, are also debated. A recent government commission's analysis of the Newfoundland processing sector concluded that a harvester only IFQ program did not do away with a race for fish and that processing shares might reduce competition for landings that contribute to that race [24]. Notwithstanding an explicit statutory prohibition on the use of processor shares in other US fisheries [20], fears of this program being seen as a precedent for other domestic fisheries has led the US Congress to hold additional hearings to discuss the merit of processing shares [25] since passage of the legislation authorizing this program. These are the second set of such hearings in less than 1 year [26]. Written testimony from both hearings is available at <http://commerce.senate.gov/hearings/index.cfm>.

¹⁸An additional measure would cap the total amount of Individual Processing Quota (or the annual allocation of processing shares) for the two largest fisheries, the Bristol Bay red king crab and the Bering Sea *C. opilio* fisheries. The caps are intended to provide an opportunity for new processors and communities to participate and limit any potential windfall to historic participants. In the Bering Sea *C. opilio* fishery, the proposed 175 million pound cap was exceeded 5 times between 1990 and 2000. The Bristol Bay red king crab 20 million pound cap was exceeded 11 times in the last 33 years.

(footnote continued)

in QS, the Council has eliminated the possibility that QS holders would have different holdings of B shares (and consequently different market power with respect to processors).

¹⁵Since B shares are issued only to independent harvesters, if processor affiliates held 20 percent of all QS, 12.5 percent of each independent harvester's allocation would be B shares to maintain the 90 percent/10 percent ratio of catcher vessel A shares to catcher vessel B shares.

¹⁶Economic theory suggests that the most efficient harvesters will buy out less efficient harvesters.

Table 2

Summary of harvest allocations (allocations reported are the share of the total allocation) and ownership caps

Fishery	Estimated number of eligible vessels	Median allocation	Average of four largest allocations	Ownership cap	Number of owners over the cap
Western Aleutian Islands (Adak) golden king crab	11	0.026	0.216	0.10	^a
Western Aleutian Islands (Adak) red king crab	28	0.008	0.193	0.10	6
Bristol Bay red king crab	254	0.004	0.009	0.01	10
Bering Sea <i>C. opilio</i>	245	0.004	0.010	0.01	16
Bering Sea <i>C. bairdi</i> (EBS Tanner crab)	266	0.004	0.011	0.01	17
Eastern Aleutian Islands (Dutch Harbor) golden king crab	12	0.077	0.157	0.10	6
Pribilof red and blue king crab	110	0.006	0.031	0.02	18
St. Matthew blue king crab	138	0.008	0.015	0.02	^a

Source: [2].

^aWithheld for confidentiality.

Table 3

Summary of processing allocations (allocations reported are the share of the total allocation) and ownership caps

Fishery	Mean	Median	Average of four largest allocations	Number of processors	Allocations in excess of the 30% cap
Western Aleutian Islands (Adak) golden king crab	0.100	0.008	0.244	10	^a
Western Aleutian Islands (Adak) red king crab ^b	0.100	0.008	0.244	10	^a
Bristol Bay red king crab	0.053	0.017	0.156	19	0
Bering Sea <i>C. opilio</i>	0.045	0.020	0.145	22	0
Bering Sea <i>C. bairdi</i> (EBS Tanner crab)	0.037	0.006	0.150	27	0
Eastern Aleutian Islands (Dutch Harbor) golden king crab	0.125	0.060	0.233	8	^a
Pribilof red and blue king crab	0.067	0.038	0.173	15	0
St. Matthew blue king crab	0.077	0.043	0.193	13	^a

Source: [3].

^aWithheld for confidentiality.^bAllocation is based on the WAI (Adak) golden king crab allocation.

summary statistics for the allocations of processing shares in the different fisheries.

Processor shares would be transferable, including leasing of PQS (or equivalently, the sale of IPQs) subject to use and ownership caps. As with harvest shares, transferability of processing shares may facilitate decapitalization, efficiency, and the coordination of deliveries. New processors could enter the fishery by purchasing PQS or IPQs or by purchasing crab harvested with Class B shares. Ownership of PQS would be limited to 30 percent of the outstanding PQS in a fishery. A “grandfather” provision would exempt from the cap initial allocations of shares in excess of the cap.

The number of allocations in excess of the ownership cap in each fishery is also shown in Table 3.

4.3. Cooperatives

To improve efficiency in the fisheries, the program would permit harvesters to form voluntary cooperatives associated with one or more processors holding PQS. Although a cooperative would not be bound to deliver any harvests to its associated processor provided that it complies with the delivery requirements of the program associated with the harvest and processing shares, the processor association is intended to facilitate delivery

coordination. Both sectors could realize efficiencies through well coordinated activities and flow of product. Harvesters can benefit by the cooperative relationship through which shares can be quickly traded under prearranged terms and conditions. These trades should help harvesters consolidate their remaining shares on a single vessel at the end of the season when a small portion of each vessel's allocation is remaining. In the pollock cooperatives organized under the American Fisheries Act, harvesters have effectively coordinated harvests so that less than 1 percent of the TAC is unharvested. In the halibut and sablefish fisheries, which are managed with IFQs with limited leasing, harvesters have left more than 5 percent of the TAC unharvested, particularly in the early years of the program. Processors can also benefit from cooperatives, which can coordinate deliveries so that processing crews and equipment have less down time between deliveries. Delivery coordination can also reduce queuing of harvesters waiting to offload their harvests, minimizing deadloss of harvested crab. Managers can also reduce administrative burdens and costs in a cooperative structure because annual IFQ allocations of individuals that are cooperative members would be made to the cooperative with harvest oversight at the cooperative level.

4.4. Binding arbitration

BSAI crab fisheries have a history of contentious price negotiations. Harvesters have often acted collectively to negotiate an ex vessel price with processors, at times delaying fishing to pressure price concessions from processors. Because the processing share allocations under the program are novel, the effects on price negotiations cannot be fully predicted. To guide price negotiations under the new program, the Council has included a provision for binding arbitration for the settlement of price disputes. The binding arbitration system is intended to compel shareholders to offer reasonable terms and, if necessary, establish a reasonable price when a negotiated price cannot be reached. In a system with a one-to-one relationship of harvest and processing shares, the market of persons for a shareholder to transact with will be limited. The concern is most acute for the shareholders from each sector that are last to contract for their shares.¹⁹

The arbitration program would apply only to A shares, which require delivery to a holder of processing shares. The arbitration standard directs the arbitrator to identify a price that preserves the historic division of

first wholesale revenues between the two sectors. Industry participants supported the historical division of revenues as a fair and workable method of preserving the balance of interests of the two sectors in the fisheries.²⁰ The arbitrator would be permitted to consider other relevant factors, such as changes in product markets and prevailing prices, when applying this standard.

The price settlement process outlined in the arbitration program would begin with an industry selected market analyst and arbiter developing a market report and a non-binding price formula. The non-binding price formula is intended to provide a benchmark price that will be a starting point for negotiations and minimize the number of price disputes as negotiations progress. Participants are provided with latitude to settle a price that varies from the announced price to accommodate individual circumstances, such as delivery timing and location. After the negotiating period, harvesters could unilaterally initiate a binding arbitration proceeding with any holder of uncommitted processing shares by committing deliveries to that processor. The non-binding benchmark price would be used as a guide by the arbiter, but the delivery price would be at the discretion of the arbiter. Each of the binding arbitration proceedings would involve a single processor and one or more harvesters. The arbitration would be final offer, under which the arbiter is limited to choosing between two final offers submitted, one from each party.²¹

The first stage of the two-stage arbitration structure should minimize disputes by providing participants with a synopsis of market conditions and an early signal of a reasonable price on which offers can be based during the negotiation period. The second stage binding arbitration proceedings are conducted at an individual level that provides for the resolution of all issues raised by the parties to the price dispute.²²

²⁰ Alternative standards considered by the committee, including a "competitive price" or a price that preserves the "historic division of rents" in the fishery. The abstract nature of these concepts makes application of either standard very complicated and less predictable than many participants were willing to accept.

²¹ In a proceeding with multiple harvesters, a processor would submit a single final offer. Harvesters could either act collectively (to the extent permitted by the Fishermen's Collective Marketing Act of 1934), submitting a single offer for several fishermen, or act independently, with each harvester submitting a single bid.

²² An experimental economic analysis of two arbitration structures also suggests that the establishment of a fleetwide price could stimulate additional competition among processors. That analysis examined an arbitration structure that set a fleetwide price for landings prior to the 'marrying' of holders of unused harvesting and processing shares and an arbitration structure that established prices for each processor based on individual arbitration proceedings. In the experiment, the fleetwide price (which would apply to all "A share" deliveries) gravitated toward a competitive market price over the course of several seasons. Whether this phenomenon would occur if the fleetwide price model were implemented is uncertain. "A share" prices generated

¹⁹ The Department of Justice has expressed some concerns about the arbitration structure and whether the information made available under the structure might create opportunities for antitrust violations [23].

4.5. Regional and community protection measures

The rationalization program contains several provisions intended to protect the interests of communities that depend on the fisheries. Development of these provisions required the Council to balance the interests of several communities not only against one another, but also against the interests of the harvesting and processing sectors. St. George and St. Paul in the Pribilof Islands depend on the crab fisheries as their economic base and could suffer from consolidation of activities in ports in the Aleutians and Alaska Peninsula that might be stimulated by slowing the race for fish. Adak is developing its crab industry after the recent departure of the military. Dutch Harbor has long depended on the crab fisheries and is home to several processors that support fleets in many fisheries. King Cove is highly dependent on a single processor active in both crab and groundfish fisheries. Kodiak, historically dependent on crab fisheries in the Gulf of Alaska, has maintained an interest in the more distant Bering Sea crab fisheries through its fleet and some of its processors.

Many of the measures, including the underlying dual share structure, are intended by the Council to provide community protections absent in a more traditional harvester-only IFQ program. Allocation of processing shares for 90 percent of the TAC is intended to support communities' historic participation by tying quota to community-based processing. This community link is intended to provide stability to not only the processing sector but also to supporting industries in the communities.²³

To maintain the historic regional distribution of landings in the crab fisheries, the Council has chosen to regionalize harvest and processing shares. QS, Class A IFQ (which requires delivery to a processor holding unused IPQs), and processor shares would be regionally designated under the program based on the location of the activity that gave rise to the allocation. Crab harvested with regionally designated IFQ would be required to be delivered to a processor in the designated region. Likewise, a processor with regionally designated shares would be required to accept delivery of and process crab in the designated region. Communities in the Pribilof Islands are the prime beneficiaries of the regionalization of the program.

Allocation of Community Development Quota (CDQ) will be increased from its current level of 7.5–10 percent of the TAC. The CDQ program is an economic development program under which harvest allocations are made to groups representing 65 rural Western Alaska communities to facilitate fishing activity and economic development. Among the primary beneficiaries of this program are resident Native Alaskans, who make up in excess of 80 percent of the population of participating communities.

A 2-year “cooling off period” would be established during which processing shares cannot be relocated from the community where the historical processing occurred that led to the allocation. At the beginning of share-based management, trading of shares could lead to rapid consolidation in the processing sector, as some processors may choose to exit the fisheries. The “cooling off period” is intended to provide a period of general stability for processors and communities to adjust to the program and provide communities with an added opportunity to entice processors to maintain existing facilities under the new program.²⁴ A right of first refusal will also be granted to community groups and CDQ groups from communities with significant crab processing history on the sale of any processing shares for use outside of the community.²⁵ Exceptions to the right would allow a company to consolidate operations among several commonly owned plants to achieve intra-company efficiencies and to lease shares temporarily outside of a community. To exercise a right of first refusal a community group would be required to meet all of the terms and conditions of the underlying transaction. Community representatives that participated in the development of the right of first refusal provision were well-aware of the potential for companies to use the exceptions to the right and the performance requirements to avoid the potential for a community to exercise the right.²⁶ Most of these community representatives, however, believe that the right of first refusal will provide their communities with some leverage to work with processing companies to maintain interests in their communities. Community and CDQ groups that would receive the right of first refusal would also be permitted to purchase harvesting and processing shares in the open market to enhance fisheries activities for their communities.

(footnote continued)

by the model that used separate arbitration proceedings for each processor showed no similar tendency toward the competitive price, even though the same arbitration standard was applied.

²³Some commentators believe a more direct community protection than allocation of processing shares is preferable [23]. In assessing community protection under the program, however, care should be taken to consider the entire suite of community and regional protections [5].

²⁴Relatively small amounts of processing shares would be permitted to be moved from a community during the “cooling off” period to facilitate coordination of deliveries.

²⁵The right of first refusal would be granted for any community with in excess of 3 percent of the qualified processing history in any fishery.

²⁶A community right of first refusal on harvest quota in the Icelandic fisheries is said to have provided little protection to communities that hold the right because share holders have structured transactions to avoid triggering the right [18].

4.6. Captain and crew share (C share) allocation and crew provisions

The rationalization program would also protect captains in the crab fisheries by allocating three percent of the TAC to eligible captains as a separate class of shares (C shares). The allocation to captains would be based on the same qualifying years and computational method used for vessel allocations. To be eligible to receive an allocation, a captain would have to meet certain minimum participation requirements that demonstrate both historic and recent participation. To ensure that C shares benefit those that actively fish, C shares may be purchased only by persons (captains and crew) who demonstrate active participation in the fisheries and meet sea time eligibility requirements. C share holders must actively fish any shares held.

The allocation to captains is intended to provide additional leverage to captains and crew when negotiating contracts with vessel owners.²⁷ The extension of seasons under the program is likely to lead to a reduction in vessels in the fishery with a commensurate reduction in crew. Slowing the pace of fishing could also reduce crew size. Anecdotal evidence from some rights-based fisheries (including the Alaskan halibut and sablefish fisheries and the Alaskan pollock fishery) is that some crew have experienced reductions in crew shares or a detrimental change from crew share compensation to wage compensation because of the increased competition for jobs resulting from the management change, see also [27].

4.7. Data collection and annual and period reviews

Data availability frequently limits the analysis of economic impacts of fisheries and fishery management. A mandatory data collection program would collect cost, revenue, ownership, and employment data regularly from the harvest and processing sectors to facilitate the study the economic and social impacts of the program. To determine the effectiveness of the program in meeting its objectives, the Council has developed a program of comprehensive reviews. Annual reports would supply summary information concerning the fisheries. A initial review of would be conducted 18 months after implementation to assess the effects of processing shares and arbitration on pricing. A broader preliminary review would be conducted at three years. A full review of the program would be undertaken 5 years after implementation. This review would be intended to objectively measure the success of the program in

²⁷ The negotiating leverage created by the allocation will depend on whether the C shares are 3 subject to the processor share landing requirements, which is scheduled to occur 3 years after implementation.

addressing the concerns and achieving the goals and objectives specified in the Council's problem statement and the Magnuson–Stevens Act standards. The review would include an assessment of options to mitigate negative impacts of the program. Additional comprehensive reviews would be conducted every 5 years.

5. Implications of and challenges for the Crab Management Program

For the Council to view its program as a success several goals will need to be achieved. This section examines some of those goals and also some of the more imposing hurdles to the success of the program. Some characteristics of the fisheries and their participants that could aid in meeting these challenges are discussed.

5.1. Implementation

Implementation of the program will require the allocation of harvest shares to license holders and captains and processing shares to processors. All shares will be regionally designated based on where landings that led to the allocation occurred. In addition, processing shares will be designated by community for establishing the community protections. Developing each of these allocations is a substantial task requiring detailed landing records. Although the allocations are daunting, available records should facilitate the task. The State of Alaska collects fish tickets for all landings creating a historical record that can be used for analyzing the fisheries and administering certain management programs. In addition, State Commercial Operator's Annual Reports required of processors can be used for verification of fish ticket data, in some cases. The initial allocation of harvest shares will be aided by the current limited entry program, the License Limitation Program (LLP), which will be used to determine harvester eligibility.

Based on the analysis supporting the Council's selection of the preferred program, approximately 300 vessels, 30 processors, and 200 captains will qualify for allocations. The number of allocations is substantially less than the 6000 persons that applied for allocations in the halibut and sablefish program implemented by the Restricted Access Management Division of the National Marine Fisheries Service, the same agency that will administer the crab program allocations [28]. Given the available data and the experience of managers from administering the halibut and sablefish IFQ program, administration of the initial allocations, while time consuming, should be manageable.

5.2. Inseason management and environment implications

In the current derby fisheries, managers monitor harvests by voluntary inseason reports and attempt to time the closure of the fishery with completion of the harvest of the guideline harvest level (GHL), a range identifying an acceptable total catch. Although managers have become very good at estimating total harvests during the season, the GHL may be exceeded through no fault of the managers because inseason monitoring cannot keep pace with harvests in season. For example, in the Bering Sea *C. opilio* fishery the harvest exceeded the GHL in every year from 1995 to 2000.

In the share-based fishery proposed, total catch is likely to be managed more precisely under a TAC, which is a specific catch limit. In addition, the individual allocations under the proposed management also increase accountability and decrease the chance of overharvests from the fishery.²⁸ Overages will be forfeited under the program and underages will not be credited in the following year.

Reductions in bycatch mortality could also result from the change in management.²⁹ In general, crab mortality from bycatch should decline under share-based management. Harvesters in the current race for fish deploy and retrieve gear in relatively short cycles. Fixed share allocations in a share-based fishery will allow harvesters to use longer soak times allowing crab pot escape mechanisms to function reducing harvests and discards and associated mortality of undersized and female crab. Relaxation of pot limits, currently in place to allow managers to control effort, should also contribute to longer soak times. Harvesters with fewer time constraints should also be able to fish with greater care, reducing the number of pots that are lost on the grounds each year. Reducing the number of pots lost each year would help reduce crab mortality caused by “ghost fishing”.³⁰

Although total landings may be more precisely achieved by the program, a competing effect could arise if harvesters perceive a benefit to high grading. High grading is likely to occur if the increase in revenues from discarding low value, barnacled or brown shell crab and harvesting high value, clean shell crab exceeds the

increase in cost of sorting, making discards, and additional harvests.³¹ The time pressures of the current derby fishery reduce the benefits of high grading since a harvest share is sacrificed by discarding crab. Under the new management, discards will not reduce harvest shares. To the extent that efforts of the harvest sector to increase quality of catch increase discard mortality or have stock effects, these efforts could reduce the benefits derived from the fishery in the long run.³² The extent and effects of any high grading problem cannot be predicted. More extensive monitoring will be necessary to determine the extent of high grading. If necessary harvest strategy modifications could be made to curtail high grading or mitigate its stock effects. Vessel Monitoring Systems and increased observer coverage and dockside sampling are needed to determine if changes in fishery selectivity occur. If changes are noted, the harvest strategies used to determine TACs will need to be modified accordingly.

5.3. Markets for shares and coordination of the industry

The harvest share/processing share system complicates the fishery operationally. The one-to-one relationship between processing shares and Class A harvest shares (which require landing with a holder of unused processing shares) will require that each share holder match up shares with a share holder in the other sector. Regional designations on these shares and the 2-year community designations on most processing shares will impose additional coordination requirements on harvesters and processors that need to meet these geographic landing requirements. Although this level of coordination may seem insurmountable, a few characteristics of the fisheries and the management program should help industry reach an acceptable level of coordination. First, the fisheries have relatively few participants, many of whom know each other and have worked together for several years. Approximately 30 processors qualify for allocations under the program. A large majority of processing shares will be allocated to seven or eight large processors, substantially limiting the number of shareholders that harvesters must work with to coordinate deliveries. The few relatively small processors could pose some coordination problem to harvesters that do not match shares with the large processors. A second factor that is likely to facilitate coordination is the structure of the preseason arbitration

²⁸ Underharvesting, which is likely to occur under a share-based management, can be limited by liberal share transfer rights and coordination among harvesters. For example, in the Bering Sea pollock fisheries, coordination of the pollock cooperatives has led to harvests of greater than 99 percent of the TAC without overharvest.

²⁹ Bycatch of groundfish in the crab fisheries is very limited and is not viewed as an environmental problem in these fisheries.

³⁰ Ghost fishing is a term used to describe pots that are lost, but a still in a condition to continue catching crab or other fish. Crab trapped in the pots and die, effectively rebaiting the trap. Depending on how long it takes for the twine on the escape mechanism in a pot to decompose, a lost pot may continue ghost fishing for several months.

³¹ Anderson [29] describes the conditions in an IFQ fishery that are likely to lead to high grading in an IFQ fishery. See also [30].

³² Issuance of fixed harvest allocations that extend several years into the future are argued by some to reduce the incentive for detrimental high grading, if fishers perceive a future cost to high grading. Others caution that the assumption that long term allocations will protect against overharvests depends on the nature of the stock in question, see [9,11].

program. To take advantage of arbitration, harvesters will need to commit landings to holders of unused processing shares in the pre-season. This matching of shares should result in the coordination of landings necessary to meet the landing requirements of the dual share system. A third factor that is likely to aid in coordination of landings is the program structure for trading of shares. Harvest shares are freely leasable, so harvesters can fish the shares of others, if needed to coordinate landings. In addition, the cooperative structure promoted by the program will allow harvesters to cooperatively harvest allocations in accordance with pre-season cooperative agreement. Although cooperatives are voluntary, most harvesters believe cooperatives will become the norm in these fisheries. Cooperatives add to coordination by creating an institution with pre-established rules for exchange of harvest shares. Cooperative member's annual harvest allocations will be made to the cooperative, so share transfers within the cooperative need not be administered by fishery managers.³³ Lastly, the high value of these fisheries and the substantial investments necessary to participate create a significant incentive for participants to achieve the coordination necessary to fully harvest allocations. Although coordination of landings under the dual share allocation will pose a challenge to participants, the nature of the fisheries and the management structure should aid in coordination of landings under the program.

5.4. *Fairness and equity*

The greatest controversy surrounding the program concerns its fairness. The processor share allocation is made to address the perceived inequity of a more traditional harvester-only IFQ program, in which substantial market power may shift to harvesters.³⁴ The greatest concern is expressed by some harvesters who question the equity of the sharing of rents established by the dual share allocations. Clearly, the allocation of processing shares will limit the market available to harvesters. Two program elements are intended to respond to harvester concerns about the limited competition for landings. First, the allocation of 10 percent of annual harvest shares (IFQ) as B shares (deliverable to any processor regardless of processing

share holdings) is intended to provide harvesters with additional negotiating leverage. Second, the arbitration program will provide an outside means for harvesters to settle prices for A share landings (which must be delivered to a processor holding processing shares).

The benefit of B share allocations to harvesters is uncertain and will be affected by a few factors. Because only harvesters can initiate arbitration proceedings and arbitration only applies to A shares, the arbitration program provides harvesters with the ability to separate the price determination for the two share types to induce competition among processors for B share landings.³⁵ The extent to which harvesters might induce processors to compete for B share landings by offering higher prices for A share landings is uncertain and also depends on the effects of the arbitration program.³⁶

The arbitration program creates a complex process with several facets that could affect prices. The arbitration standard directs the arbiter to select a price that preserves the historic division of first wholesale revenues while considering other relevant factors, such as product improvements and delivery location and timing. This standard was developed by an industry committee to provide certainty to the arbitration process. The ability of the arbiter to consider any relevant factors, however, adds considerable uncertainty and provides the arbiter with substantial power. An arbiter must exercise this power judiciously for decisions to be considered fair. The multistage arbitration system should help develop fairness.

In the first stage of the process general market trends are examined by a market analysis and a price is developed to inform negotiations and the future individual arbitration proceedings. This broad look at the market should ensure that harvesters that are compelled deliver to low revenue processors by the processing share program are not treated substantially different from harvesters that deliver to high revenue processors. In the second stage of the process, harvesters will have the unilateral power to initiate an arbitration proceeding by committing deliveries to a processor holding uncommitted processing shares. Providing only

³³ Pre-filing of cooperative agreements with the managers facilitates oversight of cooperative structure and membership. Landings of cooperative members are applied to the cooperative's allocation. The cooperative institution facilitates transactions, reducing monitoring and enforcement costs [31].

³⁴ To date, one study has empirically examined this issue [14]. Although the methodology of the study has drawn criticism [15,16], the premise that market power of harvesters with respect to processors may change with the allocation of harvest shares is acknowledged elsewhere [9].

³⁵ Most processors in the crab fisheries are also active in Alaska groundfish fisheries. Many crab harvesters have limited activity in other fisheries. The greater dependence of harvesters on crab fisheries is thought by some to increase the power of processors in negotiations. Some harvesters feared that this power and the leverage of processing share allocations could be used to pressure harvesters to deliver both A and B share landings to processing share holders.

³⁶ An experimental analysis of a pre-season fleet wide arbitration structure suggests that processors might compete for Class B share landings by offering higher prices for Class A share landings. The non-binding fleet wide structure selected by the Council differs from the binding fleet wide structure that was experimentally analyzed in several respects. Whether the fleet wide component of the arbitration structure selected by the Council would lead processors to compete for B share landings by offering higher A share prices is not known.

harvesters with the ability to initiate an arbitration proceeding should increase acceptance of the program to harvesters that are compelled to deliver to processor's holding shares. Whether this complex system of establishing linkages between harvesters and processors and determining prices will be perceived as fair cannot be fully predicted.

6. Conclusion

This paper describes key dimensions of the proposed management program for the Bering Sea and Aleutian Islands crab fisheries and identifies the most substantial hurdles that the program must overcome to be judged a success. First, managers will be challenged by program implementation. Implementation will require initial allocations of harvesting shares to vessel owners and captains and processing shares to processors. Harvest shares will be regionally designated and processing shares will be regionally and community designated based on the participant's landings history. Second, managers will face the challenge of protecting stocks as the incentives to high grade increase in the share-based fishery. Third, the markets for the harvest shares, captains shares, and processing shares must develop in a manner that facilitates coordination of harvesting and processing activity required by the share system and the regional landing and processing requirements. Lastly, market opportunities for harvest landings will be constrained by the requirement that deliveries be made to a processing share holder in a designated region. For the program to be considered a success, price formation in the market for landings must be perceived as fair. The long run challenge to the program is to achieve acceptance among all stakeholders—industry, environmental groups, and the public. Recognizing the complexity and controversy of its task, the Council has already acknowledged the need for a regular, rigorous review of the program once implemented and expressed a willingness to amend the program to mitigate unintended consequences. Only with such a commitment can the Council ensure the success of this program.

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