

**Can a novel management plan for the Bering Sea and Aleutian Islands
crab fisheries succeed?**

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Abstract

Since their inception, Bering Sea/Aleutian Islands (BSAI) crab fisheries have attracted participants willing to undertake great financial and personal risks to participate in these high valued fisheries. Although entry to the fisheries is limited, excess capital and overcapacity, together with stock declines, have resulted in a race for fish. The shortest season is in the Bristol Bay red king crab fishery, which has been prosecuted for less than one week in recent years. Efforts of managers to protect declining stocks by reducing allowable catch have increased the economic stress on participants and communities that depend on these fisheries and increased pressure on participants to take greater risks.

For several years, the North Pacific Fishery Management Council worked with participants to address these problems in the crab fisheries through series of working groups and management measures. In 2001, Congress stepped in, directing the Council to assess various rationalization¹ programs for the fisheries, including individual fishing quotas (IFQs), processor shares, cooperatives, and quotas held by communities. The outcome of the Council process is a new and unique management program selected by a unanimous vote of the North Pacific Council. The program reflects the Council's 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 quota shares are designated for delivery to holders of processing quota shares. Community interests are protected by a requirement 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 one of the most complex fishery management programs to date. The attempt to satisfy many interests creates significant hurdles that must be overcome for the program to succeed economically and environmentally.

This paper describes key dimensions of the proposed crab fishery management program and identifies the most substantial hurdles that the program must overcome for the Council to judge it a successful management program for the fisheries. 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. Most shares will be regionally 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. Each of these issues is 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.

¹ "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 (NMFS, 2003a).

The Current Management Problem

The eight major BSAI crab fisheries² 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.

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

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

Notwithstanding the limit on entry under this management program, conditions in the fisheries are symptomatic of substantial overcapacity. The three largest fisheries, the Bristol Bay red king crab, the Bering Sea *C. opilio* (or 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 derby seasons of a few days or weeks suggesting substantial overcapitalization. The Bering Sea *C. bairdi* fishery has been closed for the past several seasons as have the Pribilof blue and red king crab and the St. Matthew blue king crab fisheries due to stock declines. 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. 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 fish.

² One additional fishery, the Norton Sound red and blue king crab fishery, may be considered a major crab fishery. This fishery is managed under superexclusive permitting, obviating the problems that driving the proposed changes in management in the other fisheries.

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 hours, 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 \$ ¾ million of crab each hour of the season.

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 idle for several months of the year, suggesting substantial overcapitalization. In addition, several participants report that they are unable to breakeven in the fisheries at current harvest levels.

The Proposed Management Program

For several years, the North Pacific Fishery Management Council worked with participants to address these problems in the crab fisheries through series of working groups and management measures. In 2001, Congress stepped in, directing the Council to assess various rationalization programs for the fisheries, including IFQs, processor shares, cooperatives, and quotas held by communities. The outcome of the Council process is a new and unique management program selected by a unanimous vote of the North Pacific Council. The program reflects the Council's desire to accommodate the interests of several groups dependent on these fisheries—vessel owners, processors, captains and crew, and communities. The result is one of the most complex fishery management programs to date.

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 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. 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 TAC in each fishery. Class A shares will also be subject to regionalization, under which harvests will be required to be delivered within an identified region. Class B shares, which will permit delivery of harvests to any processor (except catcher/processors) and would not be regionally designated, will be issued for the remaining 10 percent of the TAC. The issuance of Class B shares is 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 processors and communities with the interests of harvesters.

A harvester's allocation of QS for a fishery would be based on historic landings in that fishery (excluding landings of deadloss). Specifically, each allocation is the harvester's average annual portion of the total qualified catch during a specific qualifying period. Qualifying periods were selected to balance historical participation and recent participation. Different periods were selected for different fisheries to accommodate closures and other circumstances in the fisheries in recent years. The most recent seasons were excluded in part to limit the effectiveness of efforts by participants to obtain a larger allocation by increasing participation in recent seasons when it was apparent that allocations would be based on historic harvest levels. Table 2 shows a summary

of the allocations to harvesters in the different fisheries.

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	*
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 C. Opilio	245	0.004	0.010	0.01	16
Bering Sea C. Bairdi (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	*

* Withheld for confidentiality

Source: NPFMC Crab Rationalization Database, Version 1, 2001

QS and IFQ would both be transferrable 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. 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. Different caps are chosen for the different fisheries because of different fleet characteristics and the differences in historic dependency of participants on the different fisheries.³ 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 2.⁴ 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.

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. 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 not

³ Ownership caps are applied individually and collectively. Under this rule all of a person's direct holdings are credited toward the cap. In addition, a person's indirect holdings are also credited toward the cap in proportion to the person's ownership interest. For example, if a person owns a 20 percent interest in a company that holds 100 shares, that person is credited with holding 20 shares for purposes of determining compliance with the cap.

⁴ The analysis relied on registered license holder data files, which do not show ownership holdings beyond the registered owner. Detailed ownership data necessary for full analysis of ownership is currently unavailable because of restrictions that prevent analysts from accessing detailed ownership information. Application of the rules under the program will require the submission of detailed ownership information by shareholders.

unallocated, and therefore deliverable to any processor, is intended to strike a balance of bargaining power between the harvesting and processing sectors. In addition, this unallocated 10 percent of processing could provide for entry to that sector. Generally, processing shares would be regionally designated for processing in a North or South region (corresponding to the regional designation of the Class A harvest shares). 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 summary statistics for the allocations of processing shares in the different fisheries.

Table 3. Summary of processing allocations (allocations reported are the share of the total allocation) and ownership caps.

Fishery	Median	Average of four largest allocations	Number of processors	Allocations in excess of the 30% cap
Western Aleutian Islands (Adak) Golden King Crab	0.008	0.244	10	*
Western Aleutian Islands (Adak) Red King Crab ¹	0.008	0.244	10	*
Bristol Bay Red King Crab	0.017	0.156	19	0
Bering Sea C. Opilio	0.020	0.145	22	0
Bering Sea C. Bairdi (EBS Tanner Crab)	0.006	0.150	27	0
Eastern Aleutian Islands (Dutch Harbor) Golden King Crab	0.060	0.233	8	*
Pribilof Red and Blue King Crab	0.038	0.173	15	0
St. Matthew Blue King Crab	0.043	0.193	13	*

¹ Allocation is based on the WAI (Adak) golden king crab allocation.

* Withheld for confidentiality.

Sources: NPFMC Crab Rationalization Database, Version 1, 2001.

Processor shares would be transferable, including leasing of PQS (or equivalently, the sale of IPQs) subject only to use and ownership caps. IPQs would be usable at any facility of a processor without transfer. In addition, new processors would 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.⁵ Initial allocations of shares above the cap would be grandfathered. Processing use caps for other species and regions were not included. The number of allocations in excess of the ownership cap in each fishery is also shown in Table 3.

Processor allocations are substantially more concentrated than harvester allocations. This relative concentration occurs for two reasons. First and of greater importance, there are relatively fewer processors active in the fisheries than vessels active in the fishery. Second, more complete ownership information is available concerning processors. Processor allocations were aggregated to the company level. Company ownership of facilities was determined based on existing records with the assistance of processor representatives. This allowed the analysts to obtain a fairly reliable ownership aggregation of facilities. Records of vessel ownership that are reliable are not available.

⁵ PQS ownership caps would be applied using a threshold rule for determining whether the shares are held by a processor and then the individual and collective rule for determining the extent of share ownership. Under the threshold rule, any entity with 10 percent or more common ownership with a processor is considered to be a part of that processor. Any direct holdings of those entities would be fully credited to the processor's holdings. Indirect holdings of those entities would be credited toward the processor's cap in proportion to the entities ownership.

Catcher/processor provisions

Catcher/processors participate in both the harvest and processing sectors and therefore have a unique position in the program. To protect their historic role and participation, catcher/processors will be allocated catcher/processor QS and corresponding catcher/processor IFQs under the program. These shares will carry both a harvest privilege and an accompanying on board processing privilege. Catcher/processors will be allocated catcher/processor shares in accordance with the allocation rules for harvest shares for all qualified catch that was processed on board. Holders of catcher/processor IFQs may choose not to process harvested crab, instead delivering that unprocessed crab to any other processor. Use of catcher/processor shares in this manner would be akin to the use of Class B harvest shares, which do not require the receiving processor to hold IPQs. Catcher/processor shares would not have regional designations, so the delivery of these shares will not be regionally limited.

Holders of catcher/processor shares may also sever the harvesting and processing privileges, thereby creating separate Class A catcher vessel QS and PQS. These newly severed interests would create a privilege to annual IFQ allocations and IPQ allocations, which could be held by different individuals. When severed, the resulting QS and PQS must be designated for a region with both shares taking the same regional designation. Allowing the conversion of shares permits a catcher/processor shareholder to realize the full value of shares and provides greater flexibility in using the privileges. Adding a regional designation would prevent the creation of a new class of shares—Class A shares without a regional designation—for which the market would be extremely limited.

Cooperatives

The program would permit harvesters to form voluntary cooperatives associated with one or more processors holding PQS. Cooperatives are intended to facilitate efficiency in the harvest sector by aiding harvesters in coordinating harvest activities among members and deliveries to processors. 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 small portions of their allocations 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. 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, reducing deadloss of harvested crab.

Annual IFQ allocations of individuals that are cooperative members would be made to the cooperative. Processors that associate with cooperatives would not be members of the cooperatives but would remain independent. A cooperative would not be bound to deliver any harvests to an associated processor provided that the cooperative complies with any delivery requirements of the program associated with the harvest and processing shares. Processor association, however, is intended to facilitate delivery coordination. Harvesters within a cooperative would be permitted to transfer shares freely and vessels on which cooperative shares are fished would not be subject to use caps. Shares would also be freely transferable between cooperatives, but these transfers would require filing with NOAA Fisheries Restricted Access Management office before shares could be fished.

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 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.

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 method of preserving the balance of interests of the two sectors in the fisheries. 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 can 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 could be changed to accommodate the circumstances of the transaction at the discretion of the arbiter. The arbitration proceeding would be final offer, under which the arbiter is limited to choosing between two final offers submitted, one from each party.

The first stage of the two-stage arbitration structure of this process 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.

Community protection measures

The 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. The 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 depended 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 two-pie structure of the program, are intended 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.

Several additional provisions are included in the program to protect communities. A two-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. Under this provision, all processing shares will bear a community designation, which will require processing of the share in the community for the first two years of the program. The "cooling off period" is intended to provide a period of general stability for processors and communities to adjust to the program. 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" requirement is intended to provide each historic processing community with an added opportunity to entice processors to maintain facilities in the community under the new management structure.

A right of first refusal will be granted to community and Community Development Quota⁶ (CDQ) groups from communities with significant crab processing history on the sale of any processing shares for use outside of the community. The right of first refusal is a compromise reached by a committee comprised of representatives of communities, processors, and harvesters. The provision provides flexibility for companies to consolidate operations within the company to achieve efficiencies, while providing a community and CDQ groups with a right to intervene on behalf of a community, if a local processor intends to sell its interest in the crab fisheries. These community and CDQ groups would also be permitted to purchase harvesting and processing shares to enhance fisheries activities for their communities.

Caps on the total amount of Individual Processing Quota (or the annual allocation of processing shares) would be established in the two largest fisheries, the Bristol Bay red king crab and the Bering Sea *C. opilio* fisheries. In years of low abundance processor shares will provide stability to the processing sector and historically dependent communities. As stocks increase, the caps will limit the allocation of processing shares providing opportunity for new processors and communities to participate and limits 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 to 2000. Bristol Bay red king crab 20 million pound cap was exceeded 11 times in the last 33 years.

Captain and crew share (C share) allocation

Three percent of the TAC would be allocated as a separate class of shares (C shares) that will be allocated to eligible captains. Holders of these shares will be required to be onboard the vessel fishing the shares and can transfer the shares only to active participants in the crab fisheries.

⁶ The CDQ program is an economic development program under which harvest allocations are made to groups representing rural Western Alaska communities to facilitate fishing activity and economic development in those areas.

These “owner-on-board” requirements are intended to benefit both captains and crew. Ownership caps enacted in the program are intended to ensure that a reasonable number of active captains and crew benefit from C share ownership.

Data Collection Program

A program to collect economic data from harvesting and processing sectors would be used to evaluate the success of the program. This mandatory program would collect revenue, employment, and variable cost data and any fixed cost data necessary to analyze variable costs from all participants in both sectors. A third party entity will collect the data and provide it to analysts in a blind format to ensure confidentiality.

Implications and Challenges

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.

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, where necessary. 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 6,000 persons that applied for allocations in the halibut and sablefish program implemented by the Restricted Access Management (RAM) Division of the National Marine Fisheries Service, the same agency that will administer the crab program (RAM, 2002). 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.

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, the GHL may be exceeded through no fault of the managers because inseason monitoring cannot keep pace with harvests during the short seasons. 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 under the proposed management program, total catch is likely to be managed more precisely under a total allowable catch (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.⁷ 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.⁸ 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”⁹.

Although total landings may be more precisely specified 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.¹⁰ 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.¹¹ 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 strategy¹² 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.

⁷ 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.

⁸ Bycatch of groundfish in the crab fisheries is very limited and is not viewed as an environmental problem in these fisheries.

⁹ Ghost fishing is a term used to describe pots that are lost, but are 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.

¹⁰ For a discussion of high grading in IFQ fisheries see Copes (1986). Copes also questions whether the setting of a fixed TAC is preferable to a more flexible arrangement that allows managers to close seasons with lower total harvests, if ongoing monitoring suggests stock conditions are worse than perceived at the time the TAC was set.

¹¹ 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.

¹² Harvest strategies are the rules by which TACs are set. Modifying assumptions concerning harvests and bycatch mortality in these models can accommodate some changes in harvest behavior.

Markets for Shares and Coordination of the Industry

The harvest share/processing share system, which will apply to 90 percent of the allocation in each fishery 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 two-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 program. To take advantage of arbitration, harvesters will need to commit landings to holders of unused processing shares in the preseason. This matching of shares should result in the coordination of landings required 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, a voluntary cooperative structure is promoted by the program. Harvesters may form cooperatives to harvest allocations in accordance with a 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.¹³ 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.

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.¹⁴ The greatest concern is expressed by some harvesters who question the equity of the sharing of rents established by the

¹³ 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 (Criddle and Macinko, 2000).

¹⁴ To date, one study has examined this issue (Matulich and Clark, 2002). Although the methodology of the study has drawn criticism (GAO, 2002), the premise that market power of harvesters with respect to processors may change with the allocation of harvest shares is acknowledged elsewhere (see National Research Council, 1999).

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 the harvest share allocation 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 B shares from the price determination from A shares. As a result, harvesters will be able to separate the price determination for the two share types to induce competition among processors for B share landings.¹⁵ The extent to which harvesters can 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.¹⁶

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 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.

¹⁵ 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.

¹⁶ An experimental analysis of a pre-season fleet wide arbitration structure suggests that processors might compete for B share landings by offering higher prices for 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 to processor A share price competition for B share landings is not known.

Conclusion

This paper describes key dimensions of the proposed crab fishery management program and identifies the most substantial hurdles that the program must overcome for the Council to judge it a successful management program for the fisheries. 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. Most shares will be regionally 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. The Council will need to periodically review the program and have an open mind to changes to achieve this acceptance of the program.

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