

A Share-Based Management Program for the Central Gulf of Alaska Rockfish Fishery

Mark Fina

North Pacific Fishery Management Council, Anchorage, Alaska

Abstract

In 2005, the North Pacific Fishery Management Council adopted a pilot share-based program for management of the central Gulf of Alaska trawl rockfish fisheries. The program apportions the total allowable catch into exclusive shares that are allocated to cooperatives, based on the catch history of the members of those cooperatives. Allocating exclusive shares is expected to allow the harvest to be spread over a much longer season, allowing participants to schedule their activities and save on costs of fishing and processing. Historically, participants in the rockfish fishery have focused on maintaining quality of incidental catch species (such as sablefish and Pacific cod). The change in management should allow participants, particularly those in the catcher vessel/shore plant sector, to focus added efforts on producing higher valued, better quality products from targeted rockfish. Efforts are likely to be made to serve fresh fish markets with rockfish that could not be accessed under the existing management.

Introduction

In 2003, U.S. Congress directed the Secretary of Commerce to establish, in consultation with the North Pacific Fishery Management Council (the Council), a pilot program for management of the Pacific ocean perch (*Sebastes alutus*), northern rockfish (*Sebastes polyspinis*), and pelagic shelf rockfish (which includes dusky rockfish [*Sebastes variabilis*], yellowtail rockfish [*Sebastes flavidus*], and widow rockfish [*Sebastes entomelas*]) trawl fisheries in the central Gulf of Alaska (the Central Gulf). Following this directive, in 2005 the Council adopted a share-based management program under which the total allowable catch is approx-

tioned as exclusive shares to cooperatives based on the catch history of the members of those cooperatives.¹ The program is intended to address several concerns, including providing stability to both the fishing and processing sectors and to increase product value.

This study describes the current fishery and the pilot program and examines the potential for participants to benefit from the change in management. Typically, share-based management provides participants with the opportunity to spread their catch over a much longer season, schedule their activities, and save on costs of fishing and processing. Some unique aspects of the rockfish fisheries, such as the importance of valuable incidental catch, create additional opportunities for participants to benefit from the change in management to the pilot program.

The current fishery

Under current management, the rockfish fisheries are conducted under limited access management. The fisheries open to non-trawl participants on January 1. Non-trawl participants, however, have historically harvested a very small portion of the Central Gulf rockfish total allowable catch (TAC) (i.e., less than 1%). To accommodate growth of this sector, the program would allocate 2.5% of the aggregate TAC of rockfish to fixed gear vessels. Since this sector has limited participation in the fisheries the remainder of this paper is focused on practices of the trawl gear participants. The trawl season opens in early July and ongoing catch is monitored by managers with closings timed to coincide with harvest of the TAC.

Trawl participants are subject to an aggregate limit on the amount of Pacific halibut (*Hippoglossus stenolepis*) that can be caught, all of which must be discarded as prohibited species catch (PSC). Participation records show that between approximately 5 and 7 catcher processors (vessels that processor their catch on board) and approximately 30 and 35 catcher vessels (vessels that deliver their catch to shore plants for processing) participated in the fisheries annually in recent years. The limits on entry are not constraining as approximately half of the eligible catcher processors and less than one-third of the eligible catcher vessels typically participate in the fisheries.

Examination of openings and closings in the Central Gulf rockfish fisheries from 1996 to 2004 shows that all harvests are usually made in a few weeks each year (Table 1). A general progression of targeting is also apparent, as most participants target Pacific ocean perch first,

¹ This paper draws heavily on North Pacific Fishery Management Council and National Marine Fisheries Service, "Regulatory Impact Review, Environmental Assessment, and Initial Regulatory Flexibility Analysis for Amendment 68 to the Gulf of Alaska Fishery Management Plan, Central Gulf of Alaska Rockfish Demonstration Program," June 2005. The author of this paper is a primary author of that analysis.

Table 1. Openings and closures in the central Gulf of Alaska rockfish fisheries (1996-2004).

Year	Opening for species	Opening date	Closures				Reason for closure
			Pacific ocean perch	Northern rockfish	Pelagic shelf rockfish		
1996	All	July 1	July 11	July 20	none	TAC (POP, Nor)	
1997	All	July 1	July 7	July 10	July 15	TAC	
1998	All	July 1	July 6	July 14	July 19	TAC	
1998 reopen	POP	July 12	July 14	—	—	TAC	
1999	All	July 4	July 11	July 19	—	TAC(POP, Nor)	
1999 reopen	POP, Nor	August 6	August 8	August 10	—	TAC(POP, Nor)	
1999 closure	PSR	July 4	—	—	September 3	PSC	
2000	All	July 4	July 15	July 26	July 26	TAC(POP, Nor)/PSC(PSR)	
2001	All	July 1	July 12	July 23	July 23	TAC(POP)/PSC(Nor, PSR)	
2001 reopen	Nor, PSR	October 1	n/a	October 21	October 21	PSC	
2002	All	June 30	July 8	July 21	July 21	TAC	
2003	All	June 29	July 8	July 31	July 29	TAC	
2004	All	July 4	July 12	July 25	July 25	TAC(POP)/PSC(Nor, PSR)	

TAC = Total Allowable Catch reached.

PSC = Prohibited Species Catch limit reached.

OP = Pacific ocean perch.

SR = Pelagic Shelf rockfish.

Nor = Northern rockfish.

Source: NOAA Fisheries status reports and groundfish closure summaries.

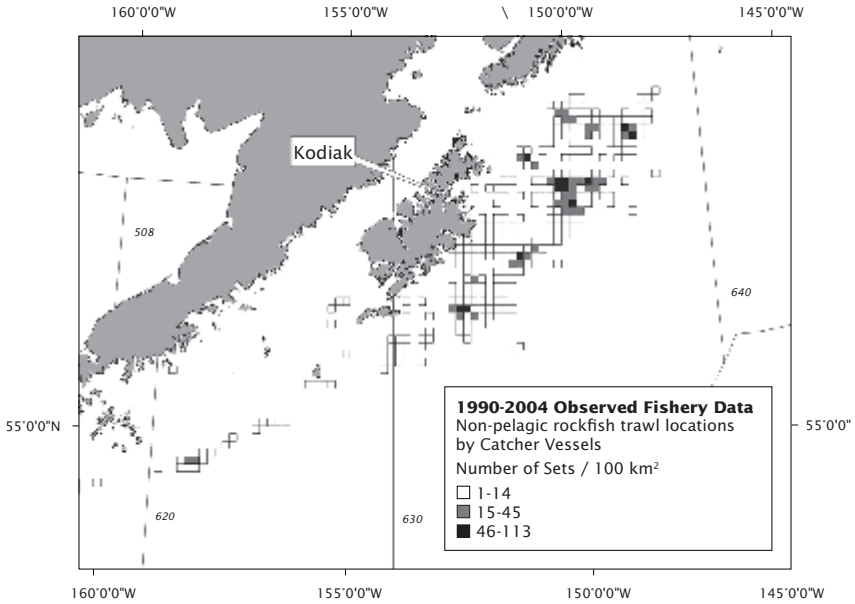


Figure 1. Locations of observed fishing effort for catcher vessels targeting rockfish with non-pelagic gear in the central Gulf of Alaska, 1990-2004 (hauls per 100 square kilometers). Source: NMFS Observer Data.

until the TAC of that species is fully harvested, after which most vessels move on to northern rockfish or pelagic shelf rockfish directed fisheries, while others move on to other fisheries in and outside of the Central Gulf. Typically, closures have resulted from the harvest of the rockfish TACs, although at times limits on catch of PSC, usually Pacific halibut, have closed the fisheries.

The short season has also contributed to the spatial concentration of catch in the fishery (Figs. 1 and 2). Catcher vessels make most harvests close to Kodiak, where a large majority of the catch is landed, because of the need to offload harvests and return to the fishing grounds to maximize total catch. In addition, processors have demanded that fishermen limit trips to less than 72 hours as a means of ensuring quality of catch. The limitation on fishing trip time effectively limits the spatial distribution of catch for catcher vessels. While catcher processors are also subject to the time limitation of the season, since they process their catch on board, their fishing activity is not spatially limited in the same manner as catcher vessels.

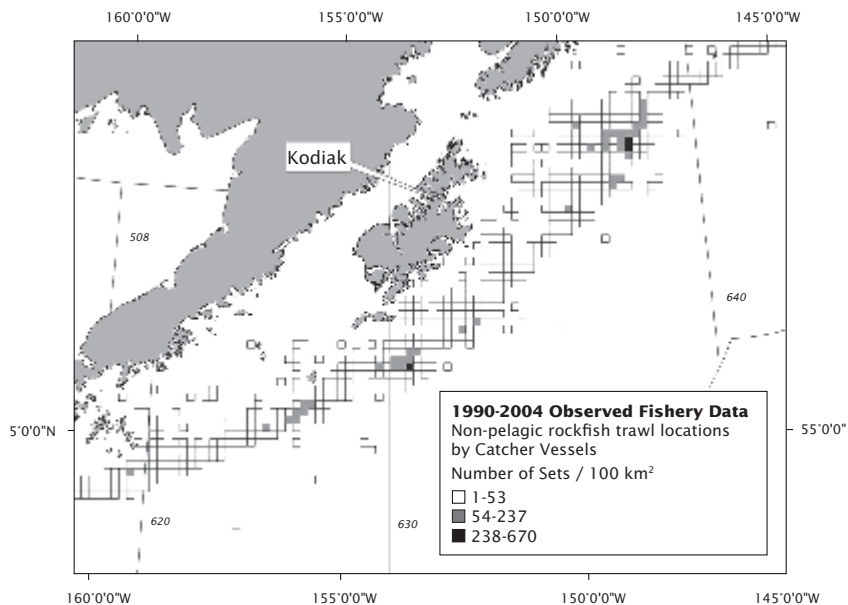


Figure 2. Locations of observed fishing effort for catcher processors targeting rockfish with non-pelagic gear in the central Gulf of Alaska, 1990-2004 (hauls per 100 square kilometers). Source: NMFS Observer Data.

Catch of Pacific ocean perch has dominated the rockfish fisheries in recent years, with harvests exceeding 6,000 t in the last 6 years of the period considered (Fig. 3). Combined catches of northern rockfish and pelagic shelf rockfish fluctuated with the lowest catch totaling approximately 4,000 t and the largest catch totaling approximately 6,500 t.

Participants catch a variety of other species during the directed Central Gulf rockfish fishery, most importantly sablefish (*Anoplopoma fimbria*), Pacific cod (*Gadus macrocephalus*), shortraker rockfish (*Sebastes borealis*), roughey rockfish (*Sebastes aleutianus*), and short-spine thornyhead (*Sebastolobus alascanus*). Incidental catch rates on rockfish targeted tows, however, are generally quite low (Table 2). For example, from 1995 through 2004, none of the main incidental catch species in the rockfish fishery was observed in 50% of the tows. In the tow that is at the 75th percentile of rate of Pacific cod catch, Pacific cod was 3.2% of the target rockfish catch (or for each ton of rockfish approximately 0.032 t of Pacific cod was caught). Shortraker and roughey were managed under a combined TAC until 2005. As a consequence, some of

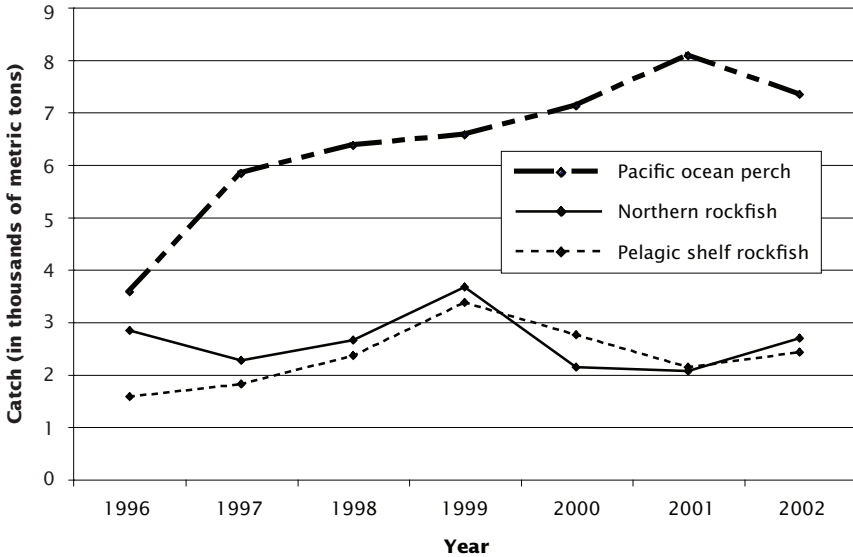


Figure 3. Catch of central Gulf of Alaska rockfish in thousands of metric tons (1996-2002). Source: NPFMC Rockfish Database, Version 1.

the data collected concerning these species fail to distinguish the two species.

Incidental catch species are currently managed under “bycatch status” with a maximum retainable allowance (MRA), which limits retention of these species to a percent of the retained target harvest (Tables 3 and 4). Comparing the low incidental catch rates from observed rockfish targeted tows (Table 2) and the overall catch rate in the fishery (in Tables 3 and 4) suggests that participants in the rockfish fishery often “top off” on these valuable incidental catch species, using single tows that target the incidental catch species during a directed rockfish trip. This conclusion is consistent with the findings of a study of “natural” bycatch rates (the rate at which bycatch occurs in targeted trawl tows in a fishery) by Ackley and Heifetz (2001), which concluded that participants in the Central Gulf of Alaska directed rockfish fisheries target sablefish to the extent permitted by MRAs. Catch of these incidental species is likely limited because of the race for the target rockfish as participants try to strike a balance of time harvesting target rockfish and valuable secondary species in an attempt to maximize their total revenues. Additional data show that overall incidental catch of Pacific cod and sablefish in the rockfish fishery are approximately 2.5% and 10% of the respective TACs of those species in the Central Gulf of Alaska. Incidental catch of short-

Table 2. Catch rates of various species in observed central Gulf of Alaska hauls targeting rockfish (1996-2003).

Species	Hauls with rockfish targets	Rockfish target hauls with species	Weight of catch of species (t)	Catch as percent of target rockfish	Catch of species as a percent of targeted rockfish in the									
					25th percentile	50th percentile	75th percentile	85th percentile	95th percentile	100th percentile				
CGOA rockfish	2,756	2,756	18,833	100	100	100	100	100	100	100	100	100	100	100
Pacific cod	2,756	1,364	337	1.79	0	0	3.23	6.40	17.12	98.55				
Sablefish	2,756	1,102	510	2.71	0	0	2.84	8.27	27.07	95.48				
Thornyhead	2,756	638	141	0.75	0	0	0	0.66	5.21	87.70				
Shortraker	2,756	232	153	0.81	0	0	0	0	2.59	92.53				
Rougheye	2,756	371	177	0.94	0	0	0	0	3.13	88.11				
Shortraker/ rougheye ^a	2,756	14	15	0.08	0	0	0	0	0	0	16.80			

^awhere shortraker rockfish and rougheye rockfish were combined in the observer data. Source: 1996-2003 GOA Observer data, with data calculations by NPFMC. Central Gulf rockfish includes Pacific Ocean perch, northern rockfish and pelagic shelf rockfish.

Table 3. Catcher processor production, product revenues, average prices, maximum retainable allowance, and percent of target rockfish (1996-2002).

Species	Product	Number of vessels	Maximum retainable allowance (as percent of target rockfish)	Percent of target rockfish catch	Product weight (t)	Product revenues (\$)	Average product price (\$)
Pacific ocean perch	Whole	7	-	-	1,817.9	1,476,859	0.368
	Western cut	2	-	-	a	a	a
	Eastern cut	20	-	-	10,663.4	11,964,004	0.509
Northern rockfish	Whole	7	-	-	2,004.4	1,227,760	0.278
	Western cut	1	-	-	a	a	a
Pelagic shelf rockfish	Eastern cut	18	-	-	2,913.0	2,121,563	0.330
	Whole	4	-	-	434.3	399,409	0.417
	Western cut	1	-	-	a	a	a
Pacific cod	Eastern cut	18	-	-	4,310.9	4,469,553	0.470
		18	20	1.4	306.7	706,072	1.044
Sablefish		21	7	4.7	1,239.5	9,701,981	3.550
Shortraker/rougheye		19	15 ^b	6.5	1,340.0	4,182,038	1.416
Thornyheads		21	15 ^b	1.6	555.8	1,858,292	1.517

^aWithheld for confidentiality.

^bRetainable percentage is combined limit on shortraker/rougheye and thornyheads.

Source: NPFMC Rockfish Database, Version 1.

Table 4. Catcher vessel landings, average ex-vessel prices, maximum retainable allowance, and percent of target rockfish (1996-2002).

Species	Number of vessels	Maximum retainable allowance (as percent of target rockfish)	Percent of target rockfish catch	Landings (t)	Ex-vessel gross revenues (\$)	Average ex-vessel price (\$/lb)
Pacific ocean perch	50	-	-	21,350.0	2,810,256	0.060
Northern rockfish	49	-	-	10,270.1	1,301,287	0.057
Pelagic shelf rockfish	49	-	-	7,181.3	932,095	0.059
Pacific cod	47	20	11.1	4,293.9	2,499,464	0.264
Sablefish	49	7	6.3	2,455.6	8,175,541	1.510
Shortraker/rougheye	46	15 ^a	0.6	231.9	60,677	0.119
Thornyhead	49	15 ^a	0.7	290.7	309,481	0.483

^aRetainable percentage is combined limit on shortraker/rougheye and thornyheads.

Source: NPFMC Rockfish Database, Version 1.

spine thornyheads by the rockfish fisheries during the qualifying years was approximately 25% of the Central Gulf total catch, while incidental catch of shorttraker/rougheye (under a combined TAC) was over half of the total harvest from the Central Gulf (NPFMC/NMFS 2005).

Rockfish fishery participants gain substantial revenues from incidental catch species. In the catcher processor sector, all target rockfish production is whole and headed and gutted fish, as most vessels in the fishery are not equipped to produce more processed outputs (such as fillets). Most, if not all, of this product is delivered to Asia, where the whole fish are typically sold into the local market and the headed and gutted products are generally reprocessed into other products, including fillets. An increasing portion of this reprocessed product is returned to U.S. markets. Average product prices of the incidental catch species are all more than double the average product price of the different target rockfish products, while sablefish product prices average seven times the highest rockfish product price. In general, fish are processed by catcher processors soon after they are caught both to maintain high quality and to accommodate additional catch. Catcher vessels also receive substantial revenues from incidental catch species (Table 4). Catcher vessel revenues from sablefish exceed those from all three target rockfish species combined, and Pacific cod revenues are larger than revenues from northern rockfish and pelagic shelf rockfish combined, but slightly less than revenues from Pacific ocean perch.

Ex vessel prices are negotiated informally by the rockfish fleet in the preseason. Fishermen often contact processors in the preseason to inquire about pricing for the season and delivery scheduling. A processor typically offers a common price to all of its fleet members. Fishermen often communicate with each other concerning processor price offers, but most perceive that little negotiating leverage exists. Usually fishermen will remain with their primary processor throughout the season delivering on a rotation, keeping trips shorter than 72 hours, to maintain product quality. Fishermen typically do not receive payment for low quality fish that cannot be marketed (except as meal). At times, fishermen will move to another processor for a delivery midseason. These movements are typically made to avoid loss of quality because of a wait to offload, and at times are facilitated by the processors. Occasionally, post-season bonuses are paid by processors in response to good market prices for products or prices of competing processors.

Incidental catch species (particularly Pacific cod and sablefish) are an important part of pricing in the rockfish fisheries. Fishermen typically inquire about the price of these incidental catch species with processors in the preseason. Prices of Pacific cod are typically based on the price from the directed Pacific cod fishery earlier in the year, with a possible downward adjustment for the absence of milt and roe and the lower quality observed in the summer months, when the rockfish fishery

is prosecuted. Sablefish prices are based on prices in the hook-and-line IFQ fishery, with some downward adjustment for lower quality found in the rockfish trawl fishery. Rockfish fishermen typically separate incidental catch species from target rockfish, in particular, sablefish, which is often stored in iced totes to maintain quality.

Quality of target rockfish is difficult to maintain because of the race to harvest. Harvesters who try to maximize catch in a tow are likely to stuff their nets, which can reduce fish quality. In addition, rockfish are relatively difficult to handle because of scales, spines, and barotrauma (i.e., bloating that occurs from their air bladders exploding when they are brought to the surface quickly). Pacific cod are usually bled after they are caught. Sablefish are usually bled and sometimes are headed and gutted. Since both species bring a substantially higher price than the target rockfish and are priced based on quality, fishermen give extra attention to their care. Shortraker and roughey rockfish and shortspine thornyheads also bring a premium price, but are caught in substantially lower quantities than Pacific cod and sablefish and therefore receive less attention.

Shore-based processors make a variety of products from rockfish (Table 5). Most of the catch is processed into whole and headed and gutted products, which sell for substantially less than fillets. A portion of the catch is processed into surimi. Since whole and headed and gutted products have substantially higher recovery rates (i.e., the amount of product recovered from the processing of a pound of round fish) than fillets, the return per pound of raw fish from fillet production is substantially higher than for whole and headed and gutted products (Crapo et al. 2004, for examples of standard recovery rates). The relatively high price for pelagic shelf rockfish is likely because of the contribution of the non-trawl fleet, which has some substantial catch of the nearshore pelagic shelf rockfish species (i.e., black rockfish [*Sebastes melanops*] and blue rockfish [*Sebastes mystinus*]) that are not included in this program, but cannot be separated in the production data.

Pilot program management

The pilot program will establish two related management programs for the two sectors participating in the rockfish fisheries (i.e., the catcher vessel sector and the catcher processor sector). The TACs of the target rockfish species will be split between the two sectors based on their respective historic catch. Two set-asides totaling 5% of the target rockfish TACs (mandated by Congress) will be made prior to splitting the rockfish TACs between the sectors. The first is intended to support incidental catch of rockfish in other fisheries; the second is intended to support a small entry level fishery for persons not eligible for the program. In addition, each sector is allocated the important incidental

Table 5. Production, revenues, and average prices of rockfish by shore-based processors in the central Gulf of Alaska rockfish fishery (1996-2002).

Species	Filets				Surimi				Whole and head & gut			
	Number of processors	Pounds of product	First wholesale revenues (\$)	Average price (\$/lb)	Number of processors	Pounds of product	First wholesale revenues (\$)	Average price	Number of processors	Pounds of product	First wholesale revenues (\$)	Average price (\$/lb)
Pacific ocean perch	8	4,997,971	7,823,210	1.565	4	3,525,587	2,310,370	0.655	10	7,670,954	2,437,360	0.318
Northern rockfish	7	2,049,212	3,132,966	1.529	2	a	a	a	7	3,184,011	920,369	0.289
Pelagic shelf rockfish	10	1,533,828	2,301,611	1.501	1	a	a	a	13	2,684,097	2,012,966	0.750

^aWithheld for confidentiality.

Source: Commercial Operators Annual Reports.

Note: Includes all catch of these species in the central Gulf of Alaska. Production exclusively from target fishery is unavailable.

catch species (i.e., sablefish, Pacific cod, and shortraker and rougheye rockfish and shortspine thornyheads) based on the historic harvests of the sector. Each sector is also allocated Pacific halibut PSC based on historic catch of Pacific halibut in the target rockfish fisheries. Two exceptions are that Pacific cod will not be allocated to catcher processors and shortraker and rougheye rockfish will not be allocated to catcher vessels, but will instead be managed under MRAs. These species are not allocated in the different cases because the sector has limited catch of the species, which could lead to allocations inadequate to support catch of target rockfish.

Under the program, participants in each sector can either fish as part of a cooperative or in a competitive, limited access fishery. Each cooperative will receive allocations of target rockfish, incidental catch species, and Pacific halibut PSC from the sector's allocation based on the target rockfish catch histories of its members. The limited access fishery will receive an allocation based on the target rockfish catch histories of sector members that choose not to join a cooperative. Cooperatives are intended to manage and coordinate fishing of their allocations. Target rockfish and allocated incidental catch species would be subject to a full retention requirement to minimize discards. All allocations to a cooperative would be constraining, so a cooperative will need to manage and monitor members' catch of target rockfish, incidental catch species, and Pacific halibut PSC to ensure that it is able to fully harvest (but not overharvest) its allocation of retainable species. To protect processors, each catcher vessel would be eligible for a single cooperative, which must form an association with the processor that it delivered the most rockfish to historically. This cooperative/processor association is intended to ensure that a cooperative lands a substantial portion of its catch with its associated processor. The exact terms of the association will be subject to negotiation, but since the cooperative agreement requires the approval of the associated processor, it will likely bind the cooperative to land a substantial portion of its catch with the processor.

The fishing season for cooperatives would be extended substantially beyond the current season, opening of May 1 and extending until November 15. The limited access fishery would open at the beginning of July and would close when its participants have fully harvested the allocation in that fishery. The limited access fishery would be managed under rules similar to the current fishery, but MRAs for incidental catch species (sablefish, Pacific cod, and shortraker and rougheye rockfish, and shortspine thornyheads) would be reduced from current levels to maintain catch levels below the allocated amount.

Fishing practices under the pilot program

Historic harvests of Central Gulf rockfish are used to make allocations under the pilot program alternatives, so distribution of Central Gulf

rockfish allocations both to and within the different sectors will be similar to the historic distribution of harvests during the qualifying years. The number of persons receiving allocations is approximately twice the average annual participation in the catcher processor fleet, and approximately 50% greater than the average annual participation in the catcher vessel fleet, showing that some participants have moved in and out of the fisheries over time.

Most catcher vessel participants are likely to join a cooperative, since the opportunity in a cooperative is likely to be better than the opportunity in the limited access fishery. Each catcher vessel will be eligible for only one cooperative, which must associate with a particular processor. Given the required processor association, it is likely that each cooperative will have limited latitude to pursue markets for their landings beyond the single associated processor. This limitation could discourage some catcher vessels from joining the cooperative fishery, if the cooperative agreement or price offer from the processor is viewed as unfair. Cooperative membership, however, is likely to be favored because of the relatively poor opportunity in the limited access fishery, which is subject to a race for fish with reduced MRAs for the valuable incidental catch species to maintain historic catch rates of those species. While it is possible that some processors may choose to exploit the bargaining power that this structure provides, since the program is limited to two years, processors who wish to maintain long-term relationships and do not wish to lose political capital in development of future programs could see a long run benefit to offering harvesters reasonable terms.

Within each cooperative, it may be anticipated that each member would receive revenues based on the catch history (or allocation) that the person brings to the cooperative, with participants that fish shares that others have brought to the cooperative receiving additional compensation for their fishing effort. Fishing within a cooperative could be far more consolidated than the underlying allocations. To save on observer coverage and operational costs, it is likely that most cooperatives will consolidate harvests to some extent, removing some vessels from the rockfish fisheries. Participants in fisheries under shared-based management often consolidate to save on operating costs (NRC 1999, Sigler and Lunsford 2001). Since the rockfish fishery is a relatively small part of the fishing for which these vessels are used, few vessels are likely to be retired altogether. Instead, vessels will be used in other fisheries (to the extent permitted by limitations intended to protect participants in those other fisheries) or idled, possibly for maintenance, during the traditional rockfish season.

The two most pronounced differences in fishing practices that are likely under the pilot program are the spatial and temporal distribution of catch. Because the programs allocate cooperative fishing privi-

leges that may be fished during an extended season, participants in the program are likely to slow their rate of harvest and distribute that harvest over greater time and a larger area. Changes in activities across the two sectors are likely to differ somewhat because of operational requirements. Catcher vessels have typically been limited in the spatial range of fishing activity by processor demands for quality of product. Rockfish fishing trips usually last less than 72 hours. As participants in the pilot program alternatives strive to improve quality of landings, it is possible that fishing trip lengths could shorten slightly. To allow for short trips, catcher vessel fishing is still likely to be concentrated in areas in relatively close proximity to Kodiak, where all of the qualified processors are located. Catcher processors, on the other hand, are not constrained by shore-based processing, and may distribute their catch over larger areas of the grounds. The extent of this distribution of catch could be limited, if catcher processors perceive a cost reduction benefit from concentrating catch in one area. If catch is consolidated onto a few catcher processors, temporal concentration of catch is more likely.

Both sectors should distribute catch over extended time periods as allowed by the longer season. The extent to which catch is temporally distributed depends on potential revenues, operational needs of participants, and catch rates. For instance, catch may be distributed throughout the season (by catcher vessels particularly) to develop alternative markets for fresh fish. One of the primary benefits of introduction of an individual vessel quota in British Columbia Pacific halibut fishery and an IFQ program in Alaska's Pacific halibut fishery was the development of fresh markets for catch from those fisheries (Casey et al. 1995, NRC 1999). While a similar outcome could occur in the rockfish fisheries, development of fresh rockfish products could be more challenging, as most processing occurs in Kodiak, which is less accessible than most ports that produce fresh Pacific halibut.

Catcher processors may have less incentive to fish outside of the summer months than catcher vessels, as most produce only frozen headed and gutted and whole products and are less likely to attempt to serve fresh fish markets that are more accessible to the shore-based fleet. Operationally, most participants are likely to schedule rockfish fishing to avoid conflicts with their participation in other fisheries. At a minimum, one would expect substantial fishing to occur prior to or following the traditional July season to allow participants to fish in other July fisheries. "Sideboard" limitations are incorporated into the program to prevent participants from increasing effort beyond their historic levels in fisheries other than the Central Gulf rockfish fisheries. These sideboards will not prevent participants in the rockfish pilot program from maintaining their historic participation levels in those other fisheries.

Catch rates could also influence the temporal distribution of fishing for both sectors. Low catch rates of rockfish or high catch rates of incidental catch species or Pacific halibut could also lead a cooperative to change its timing of rockfish targeting. Some longtime participants in the fishery suggest that rockfish aggregations are at their greatest in the summer months. If participants observe relatively high rockfish aggregations (and catch rates) in summer months, it is likely that their harvests will be concentrated in the summer regardless of the extended season. Bycatch considerations could also affect the temporal distribution of fishing effort. Participating fishermen will be strictly limited by allocations of the target rockfish species, incidental species allocations, and Pacific halibut PSC. All of the allocations are based on historic catch that occurred in the traditional July season. Full harvest of these allocations could be challenging, if catch composition changes substantially outside of the traditional July season. One reason that the current limited access opening has been scheduled for early July is to avoid Pacific halibut bycatch. The extent to which participants will be able to harvest rockfish at other times and avoid Pacific halibut cannot be predicted. If participants find that Pacific halibut bycatch is relatively high outside of the traditional season, they are likely to restrict their fishing to times when Pacific halibut bycatch rates are low. Anticipating potential bycatch issues, some participants that use bottom trawl gear have suggested that they intend to experiment with pelagic gear and other gear modifications in an attempt to reduce Pacific halibut bycatch. If successful, these changes in effort could allow for greater distribution of catch across the extended season.

Production from the fisheries under the pilot program

The effects of the pilot program on fishery product outputs are likely to vary across the two sectors. Processing by catcher processors is likely to remain similar to the current processing by that sector. Most vessels in the sector are equipped for producing a few simple products (frozen whole and headed and gutted fish). Because of vessel size and regulatory limitations, few of these vessels are likely to change plant configurations to process higher-valued, more highly processed products. Quality could improve somewhat under the new program, as vessels are under less pressure to harvest fish rapidly to protect their share of the fishery. Instead, participants may slow their rate of harvest to reduce the time between when catch is brought on-board and when that catch is processed. Trends in the distribution of products are unlikely to change.

Processing of shore-based plants under the pilot program can be expected to change substantially, through several related factors. Catcher vessel cooperatives provide a structure for coordination of harvest activity and timing of landings similar to that observed under the American Fisheries Act (AFA) cooperatives in the Bering Sea pollock

fishery (see Matulich et al. 2001 for a discussion of AFA cooperatives and a discussion of some of these effects). Catcher vessels can use the cooperative structure to time landings to accommodate processing schedules and market demands, spreading landings over the longer season. While processing employment during the season peak may decline, employment should be more stable with the scheduling of landings. Coordination of landings could also be critical to maintaining quality, as product quality can decline if fish remain in the hold for extended periods of time. Most participants may be expected to choose to sacrifice some cost efficiencies (i.e., use more inputs such as fuel) to improve quality of deliveries and time those deliveries for specific markets. This trade-off may increase costs, but should result in improvements in overall returns.

Distribution of landings over a longer period should also contribute to improved quality of production, since processors are under less pressure to process large quantities in a short period of time to secure market share. A larger portion of the catch should be processed into filets, rather than whole or headed and gutted products or surimi. Timing of landings could also be important to processors that attempt to serve time-sensitive markets. Processors participating in the program have expressed an interest in serving fresh markets in the United States that are currently experiencing a decline in rockfish products due to restrictions in fisheries off the West Coast of the contiguous United States. Distributing landings temporally will be critical to serving those fresh markets. These changes in landings should allow processor practices to evolve to serve higher value and higher quality markets.

Some processors may respond differently to the change in management. While product differentiation and pursuit of different markets can benefit both consumers and producers, the program structure may not compel some processors to aggressively pursue market opportunities. Since catcher vessels are eligible for a single cooperative associated with a specific processor, processors are likely to compete for landings only at the time of cooperative formation, which requires processor approval. This limit on the competition for landings from the fishery could reduce processor competition in output markets. For example, Anderson (2002) was critical of the less restrictive system of cooperative/processor associations created in the Bering Sea pollock fishery for its potential to decrease efficiency. While some processors may pursue any available markets, others may have less interest in extracting maximum revenues from rockfish landings, particularly if those landings interfere with their operations in other fisheries. So, while processing should expand to higher value and higher quality products, it is possible that some processors may be less aggressive in challenging high revenue markets.

Conclusion

In recent years, management of the Central Gulf rockfish fisheries with limited licensing has resulted in a race-for-fish. The race is evident in that the TAC is usually caught in the fishery over the span of a few weeks by license holders competing for a share of the catch. Some predictable (and typical) effects of this management are that participants' costs of harvesting and processing are increased as effort choices that increase catch and processing rates. Quality and value of products from the fishery also suffer (less so in the catcher processor sector where catch is typically processed shortly after it is brought on-board). In addition to these expected effects, a few less predictable effects are evident. Participants in the rockfish fisheries have typically derived a substantial share of their revenues from the harvest of valuable incidental catch species (most importantly sablefish, Pacific cod, and shortraker and roughey rockfish and shortspine thornyheads). The current management limits retention of these species to a percentage of the target catch. In response, rockfish fishermen focus efforts on increasing quantities of rockfish catch giving minimal attention to quality. "Top off" harvests of the permitted incidental catch species are usually subject to greater care in handling to maintain higher quality.

The exclusive allocations in the pilot program, together with an extended 6.5 month season, will allow participants to refocus their efforts to maximize returns from the fishery, by making production choices that improve revenues and minimize harvest and processing costs. Allocations of directed rockfish and most of the valuable incidental catch species are included in the program. Full retention of allocated species is required, with all allocations binding to reduce discards. For catcher processors, most improvement will come from reduced costs of catching and processing fish. Most vessels in the sector produce relatively high quality products and are limited by vessel and regulatory constraints from changing product forms. The catcher vessel/inshore processing sector, however, should have opportunities to change product forms while minimizing harvest and production costs. While some improvements in production from incidental catch species are possible, a large change can be expected in production of target rockfish species. Some participants have expressed interest in providing target rockfish to fresh fillet markets, previously inaccessible because of the short season and relatively unreliable quality. The program should provide additional experience and information to both regulators and participants in the fishing and processing sectors concerning the potential improvements in returns from fisheries under share-based management.

Acknowledgments

Much of the description of fishing activities in this paper is derived from conversations with participants in the subject fisheries. Several industry members and their representatives were consulted including Doug Hodel, Jay Stinson, Al Burch, Matt Moir, Joe Plesha, Tim Blott, Julie Bonney, Lori Swanson, Teresa Kandianis, Susan Robinson, and several others. Special thanks to Elaine Dinneford, Cathy Coon, and Jim Richardson, staff of the North Pacific Fishery Management Council, for assistance. Comments by Jon Heifetz and two anonymous reviewers are gratefully appreciated. Any errors, and the opinions, in this paper are those of the author.

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