The Alaskan weathervane scallop cooperative

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1. INTRODUCTION

The Alaskan weathervane scallop fishery is an example where innovative self-governance was successfully employed through a producer cooperative to reduce unwanted crab bycatch. The Alaskan weathervane scallop fishery is managed by the Alaska Department of Fish and Game (ADF&G). A Guideline Harvest Range (GHR) for scallops and a crab bycatch limit is assigned for each of nine management areas. Once either the upper limit of the GHR or the crab bycatch limit is reached, the directed scallop fishery within that area is closed. Prior to the cooperative agreement, the crab bycatch limit was regularly reached in several management areas before the upper limit of the scallop GHR was harvested. In January 2000, a group of vessel owners formed a cooperative that divided rights to both the scallop GHR and crab limit amongst all permit holders. Innovative incentives within this cooperative agreement resulted in substantial bycatch reduction, attainment of a greater percentage of the scallop GHR, and an extended fishing season.

2. FISHERY AND MANAGEMENT HISTORY

2.1 Description of fishery

The Pacific weath ervane scallop (*Patinopecten caurinus*) is one of several scallop species found in the eastern North Pacific Ocean. Its distribution ranges from Point Reyes, California to the Pribilof Islands of Alaska. The highest known densities in Alaska have been found in the Bering Sea, off Kodiak Island, and along the eastern gulf coast from Cape Spencer to Cape St. Elias (North Pacific Management Council, 2000).

Government research and private exploratory vessels began to evaluate the commercial potential of the Alaskan weathervane scallop in the early 1950s (Kaiser, 1986). When Georges Bank scallop catches declined in the late 1960s, interest in the Alaskan resource grew (Orenzanz, 1986). From 1967 to 1973, virgin scallop beds throughout the state were identified and exploited. This was followed by a period of declining scallop harvests from 1974 to 1979. A smaller, more stable fishery followed through the 1980s (Shirley and Kruse, 1995). By 1993, the fishery experienced a second influx of scallop boats from the east coast of the U.S. The fishery changed from one characterized by short trips with numerous deliveries each season to one of long trips with few deliveries as the fleet converted from icing to on-board freezing of product (Barnhart, 2000). Mean vessel size increased by 85 percent from 18.5 m in 1983 to 34.3 m in 1991 (Shirley and Kruse, 1995). By 1996, all boats participating

in the statewide fishery were converted to catcher-processors with on-board freezing capability. The average number of deliveries went from 133 (1990-1994) to 20/yr (1996–2001) (Barnhart, 2003). Crew size also increased during this period. In the early 1980s, most boats carried a crew of 5-8 depending on area. By 1993, all but the smallest boats carried a crew of 12 (Shirley and Kruse 1995).

2.2 State regulation

Although the majority of the fishery is prosecuted in federal waters (Figure 1), the North Pacific Fishery Management Council (the Council) did not exercise its management over the resource until the early 1990s. Until that time, the Council concluded that the State of Alaska's scallop management programme provided sufficient conservation and management of the Alaska scallop resource and did not need to be duplicated by Federal regulation (DOC, 2000). From the inception of the fishery in 1967 through mid-May 1993, the State of Alaska managed the fishery passively using minimal management measures (Barnhart, 2003). Scallop dredges with a minimum ring size of four-inch inside diameter were the established gear type. Closed areas and seasons were established to protect crab and crab habitat; scallop management was not based on scallop stock abundance or biology (Barnhart, 2003).

By 1992, fishery participants and management agencies became concerned with what they believed was a potentially excessive harvest capacity in the fishery (DOC, 2000). Decreased landings and a dramatic change in age composition of the resource suggested the maximum sustainable yield had been exceeded (DOC, 2000). The ADF&G responded with an interim fishery management plan. The plan included 100 percent onboard observer coverage, a ban on automatic shucking machines, maximum crew size of 12, crab bycatch caps and establishment of scallop guideline harvest ranges (GHRs) (Kruse, *et al.,* 2005). Minimum dredge ring-size was set at four-inch inside diameter, chaffing gear or other devices that decreased the legal inside ring diameter of a scallop dredge were prohibited, no more than two scallop dredges were permitted to be operated at one time from a vessel, and the opening of a scallop dredge was restricted to a maximum width of 15 feet (4.57 metres) (Barnhart, 2003). Vessels fishing within the Cook Inlet Registration Area were limited to one 6-foot (1.83 metre) dredge. These rules continued in subsequent plans, with one significant change. In 2004, Amendment 10 to the Fishery Management Plan allowed vessels operating within the Cook Inlet Registration Area to use two dredges of up to 20 feet (6.10 metres) total combined length.

The primary purpose for the restrictions of fishing gear and processing efficiency was to prevent overfishing of undersized scallops. The amount of scallops that can be processed on-board vessels is limited by how quickly they can be sorted and shucked. Because larger scallops are worth more per meat and take the same amount of time to process, a limited crew size and a ban on automatic shucking machines provide an economic incentive to target larger sized, higher-yield, mature scallops. Efficiency restrictions would also tend to allocate the resource evenly among vessels, regardless of their harvesting capacity (DOC, 1996). Crab bycatch limits were imposed to protect stocks of king, tanner and snow crabs, some of which were in a depleted or "closed" status due to low stock abundance. These crab stocks support valuable fisheries that experienced dramatic declines in the 1990s, which makes this bycatch an important and politically sensitive topic.

2.3 Council action on limited entry

Twelve vessels took part in the statewide fishery (outside of Cook Inlet) in 1993, despite the fact that efficient harvesting could have been conducted by three to four vessels (North Pacific Fishery Management Council, 1995b). The perceived need to limit access to the fishery was the primary motivation for the Council to begin its consideration of federal management of the scallop fishery in 1992 (DOC, 2000).

The Council believed that federal action was necessary because existing state statutes precluded a state vessel moratorium, and at the time, the *Magnuson-Stevenson Act* did not allow states to restrict access in federal waters. The Council drafted a preferred alternative for a fishery management plan (FMP), which included a federal vessel moratorium and shared management authority with the state. In April 1994, after public testimony and review, the Council adopted a draft FMP for the scallop fishery that proposed to establish a vessel moratorium and to delegate most other routine management measures to the State of Alaska. Under the draft FMP, non-limited access measures would be delegated to the State on the premise that all vessels fishing for scallops in the federal waters off Alaska would also be registered with the State.

While the proposed FMP was being developed into a permanent plan, a vessel without state registration began fishing for scallops in the federal waters of Prince William Sound. These waters had previously been closed to scallop fishing because the upper limit of the GHR of 22 679 kg of shucked meats had been reached. Despite the closure, the state was unable to stop the uncontrolled fishing because the vessel was not registered with the State and was therefore not subject to its authority. The U.S. Coast Guard boarded the vessel and found 24 494 kg of shucked meats on board. This amount, combined with the 22 679 kg of shucked meats already taken by State-registered vessels meant that the State's GHR for the Prince William Sound Registration Area was exceeded by over 100 percent (DOC, 2000).

As a result of this incident, an emergency closure of federal waters off Alaska to scallop fishing was implemented on February 23, 1995. The Council then implemented an FMP in which the only measure was to extend the emergency closure to a full year, during which a more comprehensive plan could be crafted (DOC, 2000).

Management measures have come in the form of amendments to the plan that implemented the emergency closure. Amendment 1 was passed on 10 July 1996. It established a joint state-federal regime under which NMFS implemented federal scallop regulations that duplicated most state rules. At the time, the *Magnuson-Stevens Act* did not allow for state management of fisheries prosecuted in federal waters. The joint management regime was implemented as a temporary measure to prevent unregulated fishing in federal waters. Federal waters were re-opened in August of 1996.

Amendment 2 was passed on 11 April 1997. It established a temporary moratorium on the entry of new vessels into the scallop fishery in federal waters off Alaska. To qualify for a permit, a vessel must have made a legal landing of scallops in 1991, 1992 or 1993, or during at least 4 years from 1980 through 1990. Eighteen vessel owners qualified for moratorium permits. The moratorium was to remain in effect until 30 June 2000, or until replaced by a permanent limited entry system.

The *Sustainable Fisheries Act of 1996* amended Section 306 of the *Magnuson-Stevens Act* to permit Fisheries Management Councils to delegate management to state authority. This set the stage for Amendment 3, which was passed on 17 July 1998 and delegated all management authority except limited access to the state.

The Council designed Amendment 4 in response to extensive public testimony that the scallop fishery suffered from excessive harvesting capacity. Public testimony indicated that vessels could not break even financially if the number of vessels fishing for scallops were to increase (DOC, 2000). Although a moratorium on new permits had been passed, not all permitted vessels were actively fishing and the industry was concerned by this latent capacity. The Council developed six alternatives and two options for a licence limitation programme (LLP). These alternatives ranged from no action, which would result in open access to the scallop fishery, to programmes that would issue between nine and eighteen licences. The Council preferred a programme that would issue nine licences.

Amendment 4 was approved on 8 June 2000. It established a licence limitation programme to replace the federal moratorium. Vessel owners who held a federal or

state permit in February of 1999 were eligible to apply for a licence if they made legal landings of scallops between 1 January 1996 and 9 October 1998. Nine vessel owners met the criteria and were issued licences.

Seven amendments were passed after the establishment of the licence limitation programme (North Pacific Fishery Management Council, 2006a):

i. *Amendments 5, 7, and 9* dealt with description and specification of essential fish habitat (EFH).
ii. *Amendment 6* established an overfishing level for weathervane scallops and added more information on bycatch data collection.
iii. *Amendment 8* established sideboard measures for the AFA qualified measures, whereby a limited amount of scallops could be taken by a vessel that was qualified as a Bering Sea pollock vessel under the American Fisheries Act.
iv. *Amendment 10* modified the existing gear restriction endorsement on two LLP licences to allow the use of two dredges not more than 20 feet in total length.
v. *Amendment 11* was a housekeeping measure to update text in the FMP to reflect current management and biological information.

3. CURRENT MANAGEMENT AND THE COOPERATIVE AGREEMENT

3.1 State limits on catch and bycatch

The Alaska Department of Fish and Game (ADF&G) divides the fishery into nine scallop registration areas (Figure 1), three of which (Yakutat, Cook Inlet, and Kodiak) are further divided into separate districts, and sets a guideline harvest range (GHR) for each area or district. GHRs are expressed as shucked scallop meats and are specified as a range from zero to the upper limit (guideline harvest limit, GHL) of the range. ADF&G may decide to close an area at any appropriate level within the range, as conditions warrant. An entire registration area or district within it may be closed in-season based on resource concerns raised by declining catch per unit effort (CPUE), by indications of little or no recruitment of scallops into the fishery, by localized depletion, or by other factors (Barnhart, 2003). ADF&G also limits the incidental catch of crab in each area to a specific number of crabs. Crabs must be discarded; they cannot be retained. The fishing season opens 1 July and extends until 15 February if the limits are not attained or if not otherwise closed by emergency order.[1] Vessels must carry observers who collect detailed information on CPUE, area and depth fished, location, scallop meat weight recovery and catch composition. Data are also collected on crab and halibut bycatch, retained scallop catch and discarded scallop catch. These data are reported to ADF&G at least three times each week during the season and are incorporated into in-season management decisions. They are also used to set GHRs for the following season (Barnhart, 2003).

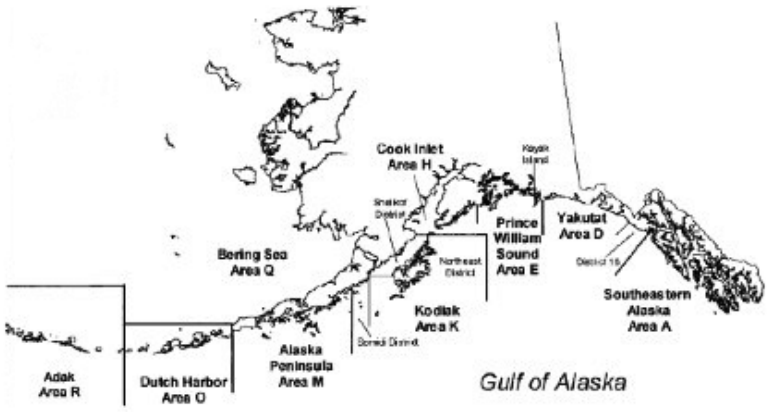
The quotas set by the ADF&G create an "Olympic" competition. In each area, vessels rush to harvest as much of the scallop allocation as possible before the quota is reached and the fishery closed. In this situation, vessel owners will not slow their harvest rate to minimize crab bycatch. They will also not experiment with crab avoidance techniques during the fishing season, as doing so would likely mean losing harvest opportunities to other vessels.

3.2 The Cooperative

In June of 2000, six scallop vessel owners formed the Weathervane Scallop Cooperative with the goal of reducing inefficiency in the fishery. Although nine permits were issued under the federal Limited Licence Plan, only six permit holders elected to join the cooperative. Of the three non-participants, one individual took part in the negotiation

[1] In this paper, annual fishing seasons are referred to by their initial year, thus the 1998/1999 season is known as the 1998 season.

FIGURE 1
Scallop management areas in Alaska



of the agreement but declined to sign, one declined in writing, and one did not respond to the request to negotiate (Ms T. Kandianis, Weather Scallop Cooperative, pers. comm.. 2002). The six participating vessels felt they represented a large enough share of the harvesting power to significantly reduce the inefficiencies of the fishery. (Two of the non-participants had minimal harvesting capacity.)

Teressa Kandianis, one of the founding Cooperative members, described the negotiation process as one in which all players sat down at the table to "hash things out". Because of the relatively small size of the fishery, everyone had a good idea of each other's historic catch levels and harvesting capacity. In order to facilitate negotiations, two large players that had been battling during Council deliberations essentially came to an agreement: to "lay down their weapons" and do what was necessary to make the agreement happen. They asked the other (smaller) players to describe their needs in terms of scallop catch and then agreed to accommodate their needs. A system was established that allowed Cooperative members to trade shares between areas. This allowed smaller boats to choose where they wanted to fish during the year (Ms T. Kandianis, pers. comm. 2007). Some scallops were left unallocated for the (small) vessels that chose not to join the Cooperative. Because these boats were not bound by the Cooperative Agreement, they were able to exceed these shares.

As stated above, nine registration areas are contained within the Alaskan Weathervane Scallop Fishery (Figure 1). Three of these areas were not included in the original Cooperative Agreement: Southeastern Alaska, which is closed to scallop fishing; Adak, which had been open only in 1995; and the Cook Inlet Area, which at the time was open only to vessels utilizing one 6-foot dredge. The Cooperative Agreement classified the remaining registration areas as "scallop-only" (Yakutat including District 16, Prince William Sound, Kodiak-Semidi District); "dual priority" (Alaska Peninsula, Kodiak-Shelikof District, Kodiak-Northeast District); or "crab-only" (Bering Sea, Dutch Harbor). Under the cooperative agreement, vessels are assigned a predetermined percentage of the ADF&G crab and scallop limits for each area. If a member receives *n* percent of the scallop limit for that area, they also receive *n* percent of the crab limit for that area. With their share of the quota determined in advance, vessel owners are able to make more rational decisions about their fishing methods.

Tanner and king crabs are more prevalent in some areas than in others. Where crabs are abundant, the bycatch limits are likely to be reached prior to the attainment of the entire scallop GHL. In these areas, harvesters have a strong collective incentive to decrease their intake of crabs. In other areas, the bycatch limit is rarely reached,

so there is less of an incentive to decrease crab bycatch. The cooperative agreement accounts for these differences by "managing by species". In "scallop-only" areas, each member's fishing activity is governed by its scallop allocation for the area. For example, if a vessel is assigned 5000 kg of shucked meats for that area, it stops fishing once that harvest is achieved. In "dual priority" areas, each member's activity is governed by its scallop allocation and its crab allocation. If a vessel is allocated 5000 kg of scallops and 500 crabs in a "dual priority" area, it must stop fishing once either of these limits is reached. In "crab-only" areas, each vessel's activity is governed solely by its crab bycatch allocation. If a vessel is allocated 1000 crabs, it can continue to fish for scallops until it captures 1000 crabs or until the *entire Cooperative's* share of the scallop GHL for the area is reached.

4. IMPACT OF COOPERATIVE

4.1 Incentives created by cooperative

The Weathervane Scallop Cooperative created a private individual transferable quota for scallops and also a private individual transferable quota for crab bycatch. The incentives for fishing under harvest ITQs are well understood. Harvesters have an incentive to transfer quota in order to achieve efficient harvests. They also have an incentive to increase the value of the landed catch by improving quality or timing landings to market demands. Evidence of the success of ITQs is typically seen as consolidation of quota on fewer vessels, increased CPUE, longer seasons and higher profits.

The incentives created by the individual bycatch limits warrant further elaboration. Prior to the cooperative agreement, each harvester faced a powerful incentive to harvest scallops as quickly as possible. The best way to increase one's share of the GHL was to fish quickly to harvest as many scallops as possible before the fishery was closed. The crab bycatch limits increased the likelihood of early closure and therefore increased the incentive to fish quickly. Vessels focused on fishing quickly rather than efficiently and crab bycatch was likely to be high. The crab bycatch limit actually created an incentive that exacerbated bycatch rates and reduced the fraction of the GHL for scallops harvested.

This situation is a classic example of a collective action dilemma (Taylor and Singleton, 1993). Each vessel makes a rational decision to increase its own benefit and in so doing decreases the benefit to the group. Scallops could be caught more efficiently and with less crab bycatch. However, it would not be rational for any vessel to change its way of fishing unless the vessel could be sure that all others would do so as well. If a vessel changes its methods in a way that slows harvesting, it will take less of the overall quota unless all others do the same.

In areas where the crab bycatch limit could constrain the catch of scallops by closing the area, harvesters with an individual crab bycatch limit have an incentive to keep their crab bycatches low enough that they can harvest their entire scallop quota. For areas where the bycatch is low and non-constraining, no *economic* incentive is created to reduce bycatch. But another incentive exists: the fleet knows that crab bycatches are a sensitive issue with crab harvesters, which is a significant fleet in Alaska. It is in the political interest of the scallop fleet to minimize crab bycatches. If crab bycatches are seen as excessive, crab harvesters might exert political pressure to restrain or even close the fishery. Usually, these kinds of political incentives create enormous free-rider problems because the costs of negative behaviour are broadly distributed. The way in which the Cooperative facilitates solution of the free rider problem is summarized by Teressa Kandianis (pers. comm., 2007), a founding and current member of the cooperative: "… the political pressure regarding bycatch accrues to the Cooperative as a unit and we have always viewed it so. It was an inherent reason for forming the Cooperative and continues to be the largest, by far, influence on Cooperative members.

The boats' captains have, despite their competitiveness, begun sharing detailed information about bycatch, gear design and scallop catchability because they realize that problems for one vessel means problems for every Cooperative member. So the political pressure is all for one, one for all. And a swift reaction to another vessel's problem that costs the other members doesn't even give us one second of pause or doubt." The enhanced security of harvest rights inherent in the Cooperative creates an environment in which cooperation can trump competitiveness in terms of crab bycatch avoidance.

The "crab-only" areas create an especially strong incentive to reduce crab bycatch. By not assigning any scallop allocations in the crab-only areas, the cooperative did not alter the scallop incentives. Because the scallop GHL had always been restrained by the crab bycatch limit, they believed that the scallop GHL was not a binding constraint. The crab-only designation created a strong incentive for vessels to learn how to catch scallops in these areas while catching few crab. In theory, one vessel could harvest the entire cooperative's scallop GHL for a crab-only area if it were able to do so without reaching its crab bycatch limit. To create an incentive to develop techniques to reduce bycatch and thereby promote maximum scallop harvest, each member acknowledged and consented to this possibility.

The cooperative agreement serves to bring individual and collective incentives into alignment. Each harvester's percentage of the resource is assured (subject to crab-only area incentives and no decision by the ADF&G to close the fishery), which allows each harvester to focus on catching this percentage more efficiently. The Cooperative also creates an environment in which captains will share information, which enables them to further reduce crab bycatch.

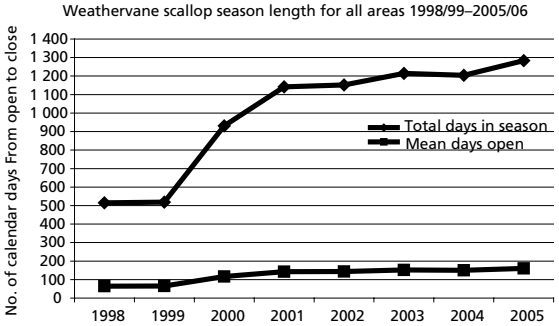
4.2 ITQ impact of scallop allocations

Scallop landings, crab bycatch and season length data were obtained from all areas for the 1998/99 through 2005/2006 fishing seasons. The Cooperative was implemented for the 2000/2001 season, so this represents two years of data before the cooperative and six years after the cooperative. Scallop GHLs and crab bycatch limits change each year based on the ADF&G annual stock assessment for each area. This fluctuation prevents straightforward interannual comparisons. It is therefore meaningful to examine the percentage of the scallop GHL or crab bycatch limit attained from year to year, rather than looking at the number of crabs or scallops caught.

The Bering Sea is the only area ever fished as "crab-only". (Dutch Harbor, although originally classified as crab-only, was not open in the 2000/01 fishing season.) For reasons that will be explained later in this section, the crab-only designation was eliminated after the 2000/01 fishing season (the first year of the cooperative), and the Bering Sea was reclassified as dual priority.

Season length, as measured by the total number of fishing days across all areas, increased significantly (Figure 2) after the establishment of the Cooperative in the 2000 season. This time series is complicated by the fact that areas may be open in some years and not in others. One area (Dutch Harbor) closed in the first year of the Cooperative and has largely been closed since. The Alaska Peninsula was closed for 2001 and 2002. Even with two areas closed in 2001, the number of days the fishery was open totalled 1 142, as opposed to 519 in 1999. In Yakutat (including District 16), the 2000 and 2001 seasons lasted

FIGURE 2
Season length for Weathervane Scallop Fishery



for the entire length (1 July to 15 February). Figure 2 also shows that for areas that are open, the mean number of days open per area increased from 64 days in 1999 to 160 days in 2005. Dramatic increases in both mean days open (average of all areas) and total days open (sum of all areas) were seen after the implementation of the cooperative. Fewer vessels operated for more days after implementation of the cooperative.

The ability to trade scallop shares has led to consolidation in the fleet. Currently only two Cooperative vessels are active, which reduces the fixed costs for the industry. Although fleet consolidation is often cited as a concern when catch rights are established, it should be noted that the small non-Cooperative boats have benefited from Cooperative efficiencies. Prior to the agreement, short season length meant small boats were limited to a few areas. It was not economically feasible for them to steam to areas that might close at any time because the crab limit or scallop GHL had been reached. Now, with longer season lengths, small boats are free to fish in areas they previously would not have targeted (Ms T. Kandianis, pers. comm. 2007). In recent years, the lengthened season has enabled smaller vessels to fish in a variety of areas. Due to the unpredictability of non-cooperative harvests, the Cooperative no longer sets aside non-member shares. Any harvests made by non-cooperative members are merely subtracted from member shares (Ms T. Kandianis, pers. comm. 2007).

There is also anecdotal information that the Cooperative reduced harvesting costs through cooperation among members. Shortly after the Cooperative's inception, data collected by the ADF&G showed dramatic CPUE differences between two Cooperative vessels fishing the same area. The boats' two owners asked the captains to share information to enable the captain with the lower CPUE to increase his harvesting efficiency. Old habits die hard, and at first the "successful" captain was reluctant to share knowledge with a "competitor". The owner persisted, reminding the captain that both vessels were now assured of their scallop allotment, and an increase in CPUE of one vessel would have no impact to other Cooperative vessels. The captain relented, and shared information about the way he set his drag that allowed the less successful captain to increase his CPUE (Ms T. Kandianis, pers. comm. 2007).

Excepting a few smaller non-cooperative boats, the fishery takes place on catcher/processor vessels that freeze the catch at sea. We would therefore not expect to see the kind of dramatic change in markets that occurred, for example, under halibut ITQs. (Under the halibut ITQs in Canada and Alaska, the dramatic increase in season length allowed that fishery to switch to a year-round fresh market with significantly higher prices.). A small change in the weathervane scallop fishery may have had a small impact on prices. The restaurant industry prefers that scallops be packaged in smaller increments. Prior to the Cooperative, the frenzied pace of fishing necessitated large-scale frozen packaging. Harvesters are now able to divide the standard 5-pound package into a preferred "split pack" of two 2.5-pound packages, which commands a higher price (Ms T. Kandianis, pers. comm. 2007).

4.3 Reduced crab bycatch and increased scallop share of GHL

Individual bycatch limits give vessels an incentive to harvest efficiently so they may attain their entire scallop share. With lower crab bycatches, the season remains open longer and the vessels can harvest a greater percentage of the GHL. The effect of this incentive is clear in the dual-priority areas. (In the scallop-only areas, crab bycatch was not expected to constrain scallop harvesting.) The incentives of the Cooperative Agreement's dual priority designation are explicitly linked to the crab bycatch limit (CBL). Figure 3 shows that the Cooperative did indeed reduce bycatch (as a percent of the CBL) and increase scallop landings (as a percent of scallop GLH) in dual priority areas. (As discussed below, the definition of dual priority areas is different in 2000 than in subsequent years.) Prior to the Cooperative, the fleet took approximately half the scallop GHL and also about half the crab limit. After the Cooperative, the

fleet took at least 70 percent of the scallop GHL in every year. This figure shows a dramatic decrease in the percentage of the crab limit attained since the inception of the Cooperative, from a high of 57 percent just prior to the Cooperative, to a low of 10 percent in 2002. The percentage of the CBL caught has remained below 15 percent for each of the last three seasons.

It could be said that the "crab-only" incentives for the Bering Sea worked much better than anticipated. In part, simply slowing down may enable a vessel to fish "cleaner" than it could in a derby-style fishery. But also, in the first year of the Cooperative, the ADF&G substantially reduced the Bering Sea scallop GHL between the time the Cooperative was formed and the beginning of the fishing season, but kept a relatively high crab limit. This created unanticipated results. One vessel was able to significantly reduce its crab bycatch rate so that they were able to harvest much of the scallop GHL before other vessels could begin fishing. Captains quickly ascertained that the entire GHL would be harvested before the crab limit was reached in the Bering Sea. Now the scallop quota was binding, and the classic "race for scallops" developed. Captains rushed to harvest Bering Sea scallops without focusing on limiting bycatch. Because this violated a primary purpose of the Cooperative Agreement, the "crab-only" designation was eliminated after the 2001 fishing season. Currently all areas are classified as either "scallop-only" or "dual priority".

FIGURE 3
Dual priority areas

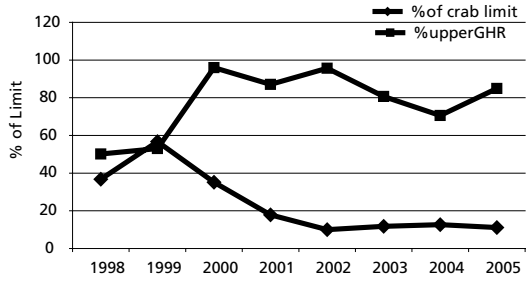
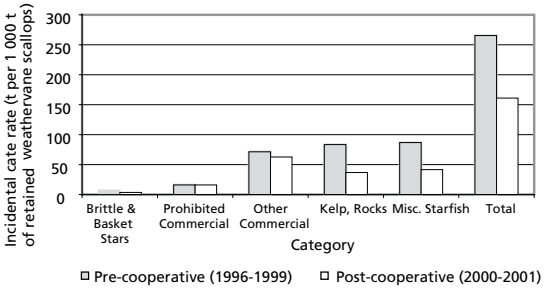


FIGURE 4
Incidental Catch Rates in the Alaska Weathervane Cooperative Fishery



Managing Our Nation's Fisheries, November 2003. Northern Economics, Inc. Presented at Weathervane Scallop and Longline CP Sablefish Fisheries The Effects of Rationalization on Bycatch Rates in the Alaska Hartley, Marcus and Jonathan King.

The increase in harvesting efficiency also resulted in a decrease in other bycatch. The catch rate for brittle stars, kelp and other incidental was shown to have dropped by 39 percent after the Cooperative's inception (see Figure 4, derived from Hartley and King, 2003). This is not the result of any direct incentive; these other species are not under any kind of limit. Three factors may be contributory. First, fishing more efficiently means fewer tows. Second, by fishing more slowly, the gear is more likely to better target the desired catch (scallops) and less at various non-target catch (whether crabs or something else). Third, vessels may reduce the time that they spend sorting unwanted catch by avoiding areas that bring up excessive amounts of unwanted catch.

4.4 Enforcement of cooperative agreement

Enforcement of the Cooperative's agreement relied on private contract enforcement. All vessels carry state-mandated third-party observers that report catch, location and bycatch rates. These data are relayed (often in real time) to ADF&G and to vessel owners, so everyone is aware of what is happening in the fishery.

In 2002, one vessel fishing in the Shelikof District (within the Kodiak Registration Area) exceeded its individual crab bycatch limit in a matter of days. The bycatch limit for the entire district (i.e., including the shares allocated to other vessels under

the Cooperative Agreement) was being approached. A Cooperative member (not the boat's owner) learned of the excessive bycatch from the on-board observer's report at approximately 5:00 pm. This Cooperative member tried to contact the vessel captain to ask him to stop fishing, but the captain was "unavailable". She then contacted the boat's owner, and threatened to file for an injunction (which was possible because the captain had violated the terms of the Cooperative Agreement). By 8:00 pm, the captain responded and the vessel had stopped fishing. In a matter of days, the offending vessel had used up three years of crab bycatch that would be allocated to that vessel under the Cooperative Agreement. As a result of enforcement provisions in the contract, the vessel was only allowed to fish in areas without crab limits in the following year. This sanction was actually less severe than what could have been assessed, based on the provisions of the contract. The severity of the punishment may have been influenced by the fact that the Cooperative was still able to harvest the entire 2002 scallop GHL in the Shelikof District. With careful fishing to avoid crab bycatch, the remaining fleet was able to harvest the Shelikof GHL within the small remaining crab bycatch allowance.

5. DISCUSSION

The Weathervane Scallop Cooperative was able to initiate a private agreement that created individual transferable quotas and individual transferable crab bycatch limits. This agreement was formed subsequent to the creation of similar cooperatives in Pacific whiting (see Sylvia and Munro, this volume) and the *American Fisheries Act* pollock cooperatives (see Wilen and Richardson, and Paine, in this volume). Undoubtedly, there was an element of learning from the experiences of these other cooperatives. (In fact, the same lawyer drafted all these agreements.)

The implementation of individual bycatch limits is unique. While the possibility of using ITQ institutions to manage bycatch has been proposed, there are few examples of bycatch ITQs where the bycatch cannot be retained. This case provides strong empirical evidence that bycatch ITQs are not a theoretical novelty, but can dramatically reduce bycatch. The effect of the cooperative's individual bycatch limits was not simply to limit bycatch to the capped value. The individual bycatch limits reduced the fraction of the total bycatch limit taken from 40–60 percent of the limit to 10–15 percent of the limit. The discussion earlier suggests why the fleet may have reduced bycatch so dramatically. The overall bycatch limit itself may have exacerbated the derby and made bycatch worse. And the political incentives to reduce crab bycatch were easier to accommodate under the allocated bycatch limits.

It is also interesting to note that the Cooperative included only six of the nine permits. An obstacle to self-governance is the difficulty of getting unanimous, voluntary agreement among harvesters. Obviously, this was possible because the remaining permits were smaller vessels whose harvests did not undermine the basic principles of the agreement. If one of these permits upgraded its vessel to fish the broader area, the agreement would probably face some challenges.

In summary, scallop landing and crab bycatch data from 1998 to 2005 provide evidence that the Cooperative Agreement increased harvesting efficiency while reducing bycatch of crabs and other species. Scallop landings increased in relation to guideline harvest limits, total crab bycatch declined, crab bycatch decreased in relation to limits and season length increased dramatically.

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7. LITERATURE CITED

Alaska Department of Fish and Game, Westward Region Shellfish Staff 2004. *Annual Management Report for the Commercial and Subsistence Shellfish Fisheries of the Aleutian Islands, Bering Sea and the Westward Region's Shellfish Observer Program, 2003.* Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 4K04-43. Kodiak, AK.

Barnhart, J.P. 1997. *Weathervane Scallop Fishery in the Westward Region*. A Report to the Alaska Board of Fisheries. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division. Kodiak, AK.

Barnhart, J.P. 2000. Annual management report for the Weathervane scallop fisheries of the Westward region, 1999/00. In: *Annual Management Report for the Shellfish Fisheries of the Westward Region, 1999*. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 4K00-55. Kodiak, AK.

Barnhart, J.P. 2002. Pers. comm. and unpublished data.

Barnhart, J.P. 2003. *Weathervane Scallop Fishery in Alaska with a Focus on the Westward Region, 1967-2002*. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 4K03-5. Kodiak, AK.

Barnhart, J.P. 2006. *Annual Management Report for the Commercial Weathervane Scallop Fisheries in Alaska's Westward Region, 2004/05.* Alaska Department of Fish and Game. Kodiak, AK.

Barnhart, J. P. & Rosenkranz, G. 2003. *Summary and Analysis of Onboard Observer-Collected Data from the 1999/2000 through 2001/2002 Statewide Commercial Weathervane Scallop Fishery.* Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 4K03-9. Kodiak, AK.

Bishop, G. 2002. *Report to the Board of Fisheries, Yakutat Scallop Fishery*. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 1J02-46. Juneau, AK.

Free-Sloan, N. 2007. *A Brief Overview of the Alaska Weathervane Scallop Fishery and the Vessel Permit Limited Entry Program.* State of Alaska Commercial Fisheries Entry Commission, Report 07-2N. Juneau, AK.

Gordon, H.S. 1954. The economic theory of a common-property resource. *Journal of Political Economy* 62: 124-142

Griffin, K., Kruse, G., Lind, K., Low, L. & Witherell, D. 1997. *Stock Assessment and Fishery Evaluation Report for the Scallop Fisheries off Alaska.* North Pacific Fishery Management Council document. Anchorage, AK.

Hartley, M. & King, J. 2003. *The Effects of Rationalization on Bycatch Rates in the Alaskan Weathervane Scallop and Longline CP Sablefish Fisheries*. Presented at NOAA's Managing Our Nations Fisheries Conference, Washington, D.C.

Kaiser, R.J. 1986. *Characteristics of the Pacific weathervane scallop fishery in Alaska, 1967-1981*. Alaska Department of Fish and Game, Kodiak, AK.

Kandianis, T. (Kodiak Fish Company) 2002–2007. Pers. comm. and unpublished documents.

Kruse, G. 1994. *Fishery Management Plan For Commercial Scallop Fisheries in Alaska.* Draft Special Publication No. 5. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division. Juneau, AK.

Kruse, G., Barnhart, J.P. & Rosenkranz, G. 2005. *Management of the Data Limited Weathervane Scallop Fishery in Alaska Fisheries Assessment and Management in Data Limited Situations.* Alaska Sea Grant College Program Publication AK-SG-05-02.

Kruse, G., Barnhart, J.P., Rosenkranz, G., Funk, G.E., Fritz, C. & Pengilly, D. 1999. History and development of the scallop fishery in Alaska. *Potential Effects of Fishing on Scallops Conference,* 10-12 June, 1999, Kodiak, AK.

North Pacific Fishery Management Council 1995a. *Fishery Management Plan for the Scallop Fishery off Alaska.* Anchorage, AK.

North Pacific Fishery Management Council 1995b. *Environmental Assessment/Regulatory Impact Review/Final Regulatory Flexibility Analysis for the Fishery Management Plan for the Scallop Fishery off Alaska.* Anchorage, AK.

North Pacific Fishery Management Council 1996. *Environmental Assessment/ Regulatory Impact Review: Final Regulatory Flexibility Analysis of Amendments 1 and 2 to the Fishery Management Plan for the Scallop Fishery off Alaska.* Anchorage, AK.

North Pacific Fishery Management Council 2000. *Environmental Assessment/Regulatory Impact Review: Initial Regulatory Flexibility Analysis for Amendment 4 to the Fishery Management Plan for the Scallop Fishery off Alaska to establish a License Limitation Program*. Anchorage, AK.

North Pacific Fishery Management Council 2003. *Stock Assessment and Fishery Evaluation Report for the Weathervane Scallop Fishery in Alaska of the Bering Sea and Aleutian Islands Regions.* Anchorage, AK.

North Pacific Fishery Management Council 2006a. *Stock Assessment and Fishery Evaluation Report for the King and Tanner Crab Fisheries of the Bering Sea and Aleutian Islands Regions.* Anchorage, AK.

North Pacific Fishery Management Council 2006b. *Fishery Management Plan for the Scallop Fishery off Alaska.* Anchorage, AK.

North Pacific Fishery Management Council 2007. *Stock Assessment and Fishery Evaluation Report for the Weathervane Scallop Fishery off Alaska.* Anchorage, AK.

Orensanz, J.M. 1986. Size, environment, and density: the regulation of a scallop stock and its management implications. In: G. S. Jamieson & N. Bourne (eds.). *North Pacific Workshop on Stock Assessment and Management of Invertebrates*. Can. Spec. Publ. Fish Aquat. Sci. 9, pp. 195-227.

Scott, A. 1955. The fishery: The objective of sole ownership. *Journal of Political Economy* 63: 116-124.

Shirley, S.M. & Kruse, G.H. 1995. Development of the fishery for Weathervane scallops, *Patinopectin caurinus,* in Alaska. *Journal of Shellfish Research* 14: 71-78.

Sullivan, J. Unpublished. Confidential Membership Agreement Cooperative for the Scallop Fishery off Alaska.

Taylor, M. & Singleton, S. 1993. The communal resource: transaction costs and the solution of collective action problems. *Politics and Society 2* (2):195-214.

Townsend, R.E. 2005. Producer organizations and agreements in fisheries: integrating regulation and Coasean bargaining. In D. Leal (ed.) *Evolving Property Rights in Marine Fisheries*. Lanham, MD: Rowan and Littlefield, pp 127-148.

US Department of Commerce (DOC) 1996. Federal Register 50 CFR Part 673 (May 10, 1996). *Scallop Fishery off Alaska: Federal Management Regime.*

US Department of Commerce (DOC) 1998. *Environmental Assessment of Amendment 3 to the Fishery Management Plan for the Scallop Fishery off Alaska.*

US Department of Commerce (DOC) 1999a. *Environmental Assessment for Amendment 6 to the Fishery Management Plan for the Scallop Fishery off Alaska.*

US Department of Commerce (DOC) 1999b. *Amendment 2 to the Fishery Management Plan for the Scallop Fishery off Alaska.*

US Department of Commerce (DOC) 2000. Federal Register 50 CFR Part 679 (April 21, 2000). *Fisheries of the Exclusive Economic Zone off Alaska; License Limitation Program for the Scallop Fishery.*