

Achievements of the Pacific whiting conservation cooperative: rational collaboration in a sea of irrational competition

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1. INTRODUCTION

The design and allocation of harvest rights and privileges¹ can profoundly influence the evolution and success of a fishery. The structure and security of rights will engender, shape or constrain the ability of rights-holders to act to promote individual and collective welfare. The use of these rights will also be influenced by the characteristics of the fishery. Such factors as the number and types of rights-holders and their working relationships will shape and influence the institutions and collective strategies that rights-holders develop. This may be particularly true when the rights are coarse, lumpy, or constrained relative to the refinement and flexibility needed to maximize fishery management objectives.

A compelling example is the Pacific whiting fishery off the west coast of the United States and Canada. Before 1997, the Pacific whiting catcher-processing fleet, along with other sectors of the Pacific whiting fishery, was overcapitalized and engaged in Olympic style or “race-for-the-resource” harvest and processing strategies. This resulted in welfare losses to the industry and coastal communities and the failure of the fishery to meet biological, economic and utilization goals articulated in the Pacific Fishery Management Council’s (Council) Groundfish Fishery Management Plan

¹ In the context of fisheries, user privileges are a weak form of access “property rights” that can be nullified or reallocated without compensation by the resource owners (usually the federal or state government). In the United States, licences, permits and individual fishing quotas are common examples of user privileges. For the purpose of this paper we use the term “rights” to represent a wide range of strong and weak rights including non-compensable user privileges.

(Larkin and Sylvia 2004, PFMC, 1997). However, in 1997 a dramatic change took place in the offshore catcher-processor sector of the fishery with the formation of the Pacific Whiting Conservation Cooperative (PWCC) (Sullivan, 2000). The PWCC ended the race-for-the-resource and generated significantly higher economic and conservation benefits. The PWCC proved so successful that it became the model for the design of the *American Fisheries Act (AFA)*, which authorized the development of the Bering Sea Pollock Cooperatives (Criddle and Macinko, 2000). In contrast, the other sectors of the Pacific whiting fishery were unable or unwilling to reach cooperative agreements and have continued to engage in “race-for-the-resource” strategies.

So what happened prior to, during and immediately following 1997 that led one sector of the fishery to engage in “rational” (welfare enhancing) collaboration, while other sectors continued to engage in “irrational” (welfare reducing) competition? What were the short and long run achievements of the Cooperative? Could the lessons learned from the Pacific whiting fishery be applied to other fisheries both inside and outside the Pacific Northwest? The following case study addresses these questions by reviewing the biology of the species, the history of the fishery and the development and achievements of the PWCC relative to the other sectors of the whiting fishery. The discussion then analyses the key factors in the success of the Cooperative and highlights potential future risks.

2. BIOLOGY OF PACIFIC WHITING

Pacific whiting (*Merluccius productus*), also known as Pacific hake, is the largest stock of groundfish south of Alaska and is ecologically the most important West coast finfish species (Livingston and Bailey, 1985; Nelson, 1985). Pacific whiting range from the Gulf of California to the Gulf of Alaska but are most abundant from Baja California to southern British Columbia. The coastal stock migrates seasonally from its wintering and spawning grounds off Baja California to its summer feeding grounds from

northern California to British Columbia. The northernmost regions have, on average, larger and older fish and a higher proportion of sexually mature females.

The stock may vary from one to four million tonnes and sustains an average annual North American harvest between 140 and 450 thousand tonnes. Industrial scale harvesting of Pacific whiting began in the US zone in 1966 and recorded landings have ranged between 100 000 to 350 000 tonnes annually (Figure 1).

Pacific whiting are moderately productive and long-lived with an average life span of 15–20 years. The average individual mature fish (3–4 years old) weighs approximately one kilogram. The stock size varies as a result of highly variable annual recruitment. Variation in recruitment appears to be environmentally driven and strong year classes appear to be linked to years of weak January upwelling (Methot and Dorn, 1995).

Pacific whiting are a relatively delicate fish and must be handled carefully after catch (Photo 1). Pacific whiting are infested with a myxosporidean parasite and the production of

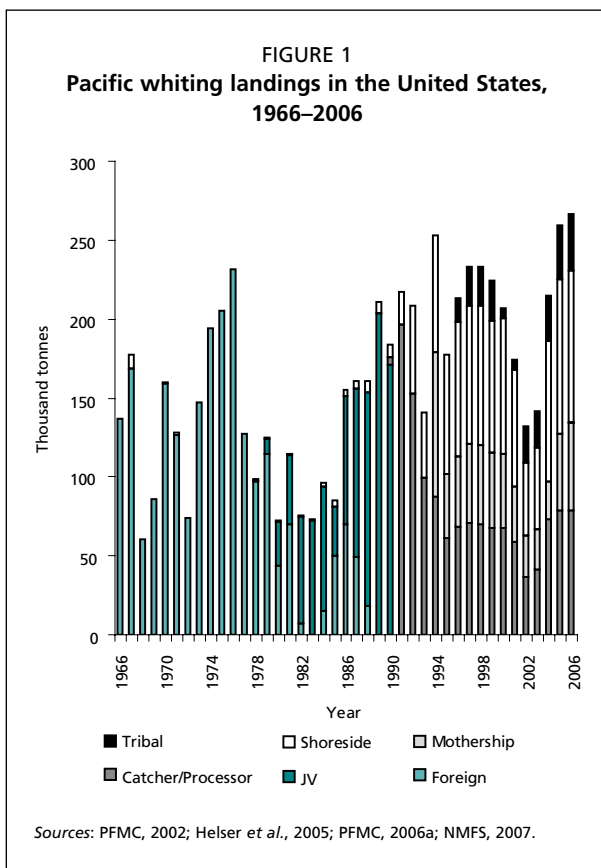




PHOTO 1
*Pacific whiting, headed and gutted
ready for freezing*

protease enzymes by the fish in response to the infestation can lead to rapid breakdown of the muscle tissue after death. Special care to avoid soft and mushy flesh includes relatively short tows and rapid chilling in refrigerated seawater tanks, particularly if there is a lag between harvesting and processing (Peters, Sylvia and Morrissey, 1995).

3. HISTORY OF THE FISHERY

3.1 1960–1990: Foreign vessels and joint ventures

Prior to the implementation of the *Magnuson Fishery Conservation and Management Act* (Magnuson Act), whiting were harvested only sporadically off the West coast and were not considered an important or economically valuable species (Nelson, 1985). In 1966, Russian and Japanese fishermen entered the fishery and were followed by other European and Asian countries during the 1970s. Some shore-based landings of whiting occurred after 1966, when government subsidies supported industry development. When subsidies ceased in 1968, the shore-side landings of whiting decreased dramatically. Even after the passage of the Magnuson Act in 1978, which created the regional fishery management councils and gave the U.S. control over all fishery resources within 200 miles of shore, domestic fishing operations did not have the necessary infrastructure, technologies, or market access to catch and process the available resource. However, joint venture fisheries were established during the early 1980s between U.S. harvesters and foreign processing vessels, including vessels from the Soviet Union, Poland and Japan.

In 1987, the West coast groundfish fleet began discussions on establishing limited entry. It would be seven years, however, before a limited access plan for the groundfish fleet would be approved and implemented.

During the late 1980s, the Japanese began to produce surimi from whiting after development of enzyme inhibitors that prevented protease enzymes from denaturing whiting muscle proteins. Surimi is a fish paste produced by dewatering fish proteins and adding chemicals and stabilizers (Peters, Sylvia and Morrissey, 1995). It is used to make seafood analogs such as “artificial” crab and shrimp. As a relatively firm, pliable, odourless and tasteless protein-based product, it can be used as an ingredient for many food products. Japan, the world’s largest surimi market, has over 200 products that include surimi as an ingredient. Prior to production of surimi, the joint venture fishery produced mainly frozen blocks of headed and gutted and fillet products (Nelson 1985, PFMC, 1997). By 1989, all foreign harvesting had been eliminated. However, except for a small amount of product processed on shore for domestic headed and gutted markets, most of the catch was still processed by foreign vessels in joint venture operations.

3.2 1990s: Allocation battles and domestication

In 1990, US factory trawlers entered the fishery. Factory trawlers, which are also known as catcher-processor vessels, harvest the fish and then process the catch directly aboard the vessel. Because of over-capitalization in the Alaskan pollock fishery and

PHOTO 2
 F.V. Pacific Glacier, an example of a
 factory trawler now operating in the
 West Coast Pacific whiting fishery



PHOTO 3
 Discharging H&G product from two
 catcher-processors, F.V. Northern Hawk
 and F.V. Northern Jaeger, Bellingham,
 Washington State



the end of year-round fisheries, these vessels were now seeking alternative fishing opportunities. Photo 2 shows an example of a current factory trawler in this fishery and Photo 3, discharging the catch of Bellingham, Washington.

Because of the huge capacity of the catcher-processing fleet, within one year all joint ventures had ceased fishing operations. In 1991, all harvesting and processing operations for Pacific whiting were domestic. Initially, the Council managed the fishery through a total allowable catch and season closures. These management tools, however, were no longer sufficient because the Council recognized that at sea processing capacity had the potential to usurp shore-side operations. In 1991, the at sea component of the fishery harvested 91 percent of the allowable catch. Of that catch, factory trawlers were responsible for 60 percent of the harvest. Catcher vessels delivering to motherships that process at sea made up the remaining at sea sector. By 1992, a cap was implemented on the amount of fish that could be processed at sea and the Council allocated the allowable catch between the two sectors (at sea and shore-side). The entrance of the factory trawlers also increased the harvesting pace and condensed the season. Before 1991, the fishery lasted eight months, but with the large increase in fishing effort in the at sea sector, the fishery lasted less than three months in 1991 (Dorn 1992, PFMC, 1997).

Tensions between the shore-based and at-sea sectors escalated into a race for the resource and a political battle for allocation and rights of access (PFMC, 1997). Shore-based fishing communities were concerned that a dislocated joint-venture whiting fleet would result in a cascading effect of displaced vessels overcapitalizing other coastal fisheries. With the backing of state government, these communities had made major investments in shore-based infrastructure to support development of a Pacific whiting processing industry. With the demonstration by the Oregon State University Seafood Laboratory that quality surimi could be produced in shore-based operations, new surimi plants were constructed in Oregon and Washington ports and mid-water trawlers were fitted with refrigerated seawater tanks (PFMC, 1997).

In 1992, the limited entry plan proposed for the west coast groundfish fleet was approved, but would not be implemented until January of 1994. The fishery was

managed under a total allowable catch (TAC), which limited the annual harvest. The Council feared that the at-sea sector of the fishery would dominate harvesting of the allowable catch and leave the shore-side sector disadvantaged. A Council proposal that would (a) force at sea participants to either process or catch whiting, but not both and (b), allocate quota based on “shore-side priority” was rejected by the Secretary of Commerce. The Council then developed new allocation rules (PMCC, 1993). Ninety-eight thousand tonnes were set aside for at sea processors and 80 000 tonnes were allocated to the shore-side sector. In addition, the Council maintained a reserve quota with priority for the shore-side fleet.

As the allocation conflict continued, a committee was appointed by the Council to resolve the allocation issues (Freese, Glock and Squires, 1995). The committee negotiated an agreement, which was to be implemented for three seasons (1994–1996). Sixty percent of the allowable catch was open for a competitive fishery where all sectors competed for the resource. The other forty percent was allocated specifically to the shore-side sector. If the shore-side allocation, however, was not used prior to 15 August, then a percentage of the remaining quota was released for open competition.

When the Council’s limited entry plan was implemented on 1 January 1994, all of the factory trawlers that had been participating in the whiting fishery were excluded since their vessels did not meet the qualifying period for receiving a groundfish permit (PFMC, 1997). There were provisions, however, that allowed factory trawlers to purchase newly created groundfish permits from qualifying catcher boats according to a formula based on vessel length and gross tonnage. On average, each participating factory trawler purchased 11 groundfish permits at an approximate cost of US\$1.5 million (PFMC, 1997). The 10 factory trawlers that bought back into the fishery replaced 109 groundfish trawl-catcher boat permits, most of which had never participated in the whiting fishery.

In 1994, four Washington coastal Indian treaty tribes were recognized by the United States as having treaty rights to fish for groundfish in the Pacific Ocean. Of the four coastal Indian treaty tribes, only the Makah Indian Nation has participated in the Pacific whiting fishery. In 1995, the Makah Indian Nation notified the Council of their intent to harvest Pacific whiting based on their claim of entitlement under treaty rights. This action created an additional sector for which the Council was required to allocate a portion of the allowable catch that “comes off the top”, prior to allocations to other sectors. The Makah tribe allocation is based on 50 percent of the proportion of the whiting resource found off the state of Washington. Beginning in 1999, the Council has allocated fish to a tribal whiting fishery using a sliding scale method proposed by the Makah tribe in 1998. The tribe has received an allocation every year since 1995 (approximately 25 000–35 000 t annually).

In 1996, the industry negotiated a five-year allocation scheme that created four distinct sectors: tribal, catcher-processors, motherships and shoreside. After providing the Makah allocation, the remaining quota shares were allocated to each sector: 42 percent to the on-shore sector; 24 percent to motherships and 34 percent to catcher-processors. Since harvests fluctuate according to the allowable harvest quota, all sectors were affected equally and the race for fish between sectors was eliminated. The race for fish within sectors, however, continued and each sector of the fishery engaged in its own unique “race for the resource” fishing competition. The effects of this race were obvious. One result was the decrease in season length. Other problems also became noticeable, including excessive bycatch, poor product quality and poor product recovery rates. These problems were prevalent in all three sectors. In addition, reductions in the allowable catch due to a decreasing stock size increased tension between the four sectors

4. EMERGENCE OF THE PACIFIC WHITING CONSERVATION COOPERATIVE

The four catcher-processing companies that bought Pacific whiting harvest rights had previously worked together in attempts to solve over-capacity problems in the Bering Sea pollock fishery (Sullivan, 2000). After two seasons, these companies realized they were facing similar problems in the Pacific whiting fishery. To maximize return on investment, they recognized the need to eliminate the race for fish. In addition, they confronted the critical need to reduce bycatch of “depleted” rockfish species and of salmon, which could result in premature closure of the fishery. The companies also realized a collective solution was possible: a voluntary quota allocation scheme within their sector.

The reauthorisation of the *Magnuson Act* in 1996 included a moratorium on the issuance of individual transferable quota (ITQ) programmes. The ITQ moratorium reflected in part some political concerns that any ITQ programme for the Bering Sea pollock fishery might allocate most harvest rights to non-Alaskan fishing companies. Coincidentally, the whiting catcher-processors were owned by some of those same companies. The catcher-processing fleet in the Alaskan pollock and Pacific whiting fisheries had limited mechanisms for rationalizing their collective behaviour given the moratorium on ITQ's. One alternative, however, was a voluntary cooperative arrangement that would mimic many of the benefits of ITQ programmes. The Council had already provided a regulatory framework that would support formation of this type of cooperative by setting a fixed number of participants in the sector and a predetermined catch allocated to the sector. Increasing the potential for achieving agreement on a plan was the small number of participants in the catcher-processor sector.

As investigations for a cooperative venture continued, the group began discussions with the Antitrust Division of the Department of Justice (DOJ) (Sullivan, 2000). Initially it was unclear whether the cooperative would need an exemption under the *Fishermen's Cooperative Marketing Act of 1934* (FCMA). The companies considered a cooperative structure in part because they might be able to qualify under the FCMA antitrust exemption. The FCMA was intended to give fishermen limited protection from the *Sherman Antitrust Act of 1890*, which prohibits restraints on trade. FCMA exemptions were originally intended to benefit small, independent producers who were insufficiently integrated to perform their own processing. The four harvester and processing companies recognized that in the case of Pacific whiting (and Alaskan pollock), cooperative behaviour, rather than restraining trade, would encourage competition in output markets. By ending the race for fish, greater quantities of higher quality product could be produced for national and international markets, potentially at lower prices while also achieving greater utilization and less waste.

Based on preliminary findings by the DOJ, the four companies began negotiations to form a cooperative founded on a mutual harvest allocation agreement. Forming a cooperative to allocate harvest shares was a new concept in the U.S. Most U.S. fishery cooperatives had been organized to improve collective bargaining power, to undertake processing and marketing or to share risks and profits (McCay, 1980; FAO, 1971). In one afternoon of bargaining, the companies agreed to specific percentages to divide their sector quota allocation, based primarily on historic catch (Sullivan, 2000). The companies agreed to allow leasing and trading of quota. The companies also agreed to employ full-time observers, even though observer coverage was not a federal requirement at the time of the agreement. The companies hired Sea State, a private centralized reporting service, to monitor catch and provide real-time reports of at sea activities. The PWCC also implemented penalties for violating various provisions of the agreement, including fees for exceeding individual harvest shares.

In mid-season 1997, the DOJ Antitrust Division issued a favorable “no enforcement intent” letter and the factory trawler fleet responded by immediately adopting the

provisions of the PWCC agreement and converting to share-based fishing operations. The DOJ findings (Klein, 1997) read in part:

“(I)t does not appear that the proposed elimination of the olympic system race to gather the governmentally-fixed quota of Pacific Whiting would have any incremental anticompetitive effect in the regulated output setting in which the harvesting agreement would take place. The Department of Justice has previously stated that reliance on an olympic race system to gather a fixed quota of fish ‘is both inefficient and wasteful’ because it is likely to generate ‘inefficient over- investment in fishing and processing capacity.’... To the extent that the proposed agreement allows for more efficient processing that increases the usable yield (output) of the processed Pacific Whiting and/or reduces the inadvertent catching of other fish species whose preservation is also a matter of regulatory concern, it could have procompetitive effects.”

Because the conversion occurred halfway through the Pacific whiting season, the fleet was able to compare key performance criteria before and after the agreement, including product recovery and bycatch rates. The changes in performance were immediate and exceeded the companies’ expectations (Sullivan, 2000).

5. PACIFIC WHITING COMMERCIAL LICENCE AND PERMIT FEES

Vessels intending to participate in the shore-based Pacific whiting fishery are required to carry an exempted fishing permit (EFP) from 2007 if they intend to land their catch unsorted. Only Limited Entry Permit holders with a trawl endorsement are eligible to fish for whiting under the Pacific whiting shore-based fishery EFP. An EFP enables vessels in the shoreside hake fishery to retain and land unsorted catch at participating shoreside processing plants. A separate EFP is required for each of the two components of the shoreside fishery: South of latitude 42° (this fishery opens 1 April) and the primary fishery, which opens 15 June.

A **Processor-State Agreement** allows for processing plants to receive unsorted catch from EFP vessels in the shoreside hake fishery. Processor-State Agreements vary slightly depending on the State of processor operation. Processors must contribute monetarily to the Shoreside Hake Observation Program (SHOP). Pre-season invoices covering the first half of the season are distributed to each processor based on the percentage of shoreside hake it landed in the previous year, or is expected to land in the current year. These invoices must be paid in full and confirmed by PSMFC prior to the state entering into a Processor-State Agreement. After closure of the fishery, invoices reflecting the total hake weight landed during the season will be distributed. This payment will cover the second half of the season.

Groundfish limited entry renewal fee with trawl endorsement is \$152. Vessels in the shoreside fishery are required to pay an Oregon Trawl Commission Fee. The fee is an *ad valorem* tax of 0.5 percent of the gross value of fish landed (Pettinger, Pers. comm., Oregon Trawl Commission). Shore-side processors are responsible for paying a landings fee. The landings fee for whiting is 1.09 percent of the gross value of fish landed (Grooms, Pers. comm., ODFW Commercial Fish Information Office). Vessels in the shoreside and mothership sectors are responsible for paying a 5 percent vessel buyback fee that is 5 percent of the gross value of fish landed (Pettinger, Pers. comm.).

Regulations require that catcher/processors and catcher vessels have limited entry permits with trawl endorsements to operate in the fishery. A groundfish limited entry renewal fee with trawl endorsement costs \$152. PWCC members are assessed a tonnage fee that is used to fund scientific research, including funding stock assessment and bycatch avoidance programmes.

On board observers that are required for motherships and catcher/processors are funded by the vessels themselves. Vessels over 125’ are required to have two observers on board, while those under 125’ required only one (PFMC regulatory branch, Pers. comm.). At a cost of \$300 a day, the average cost to the vessel for each observer was

TABLE 1
Licensing, permit, and other associated fees in the shoreside, catcher/processor and mothership sectors of the Pacific Whiting Fishery

	Shore-side	Catcher/Processor	Mothership
Groundfish limited entry permit with trawl endorsement	\$152 annual renewal fee	\$152 annual renewal fee	Not applicable
Exempted fishing permit	No fee	Not applicable	Not applicable
Required on-board observers	Not applicable	1–2 observers per boat with an average cost of \$10 550 per observer	1–2 observers per boat with an average cost of \$10 550 per observer
Processor State Agreement	Fee based on the percentage of fish landed and SHOP budget requirements	Not applicable	Not applicable
PWCC tonnage fee	Not applicable	Value not made public	Not applicable
Landings tax	1.09% of gross value of fish landed	Not applicable	Not applicable
Oregon trawl commission fee	0.5% of gross value of fish landed	Not applicable	Not applicable
5% vessel buyback fee	5% of gross value of fish landed	Not applicable	5% of gross value of fish landed

\$9 300 (ranging from \$3 950 to \$36 650) during the 2001 whiting season. In addition, training and debriefing costs would have been approximately \$1 250 an observer.

No permit or licence is required for a mothership. But, onboard observers, funded by the vessels themselves, are required for motherships and catcher/processors. Vessels over 125' are required to have two on board, while those under 125' only require one. With a cost of \$300 a day, the average cost to the vessel for each observer was \$9 300, and ranged from \$3 950 to \$36 650 during the 2001 whiting season. In addition, training and debriefing costs would be approximately \$1 250 an observer.

Vessels in the shoreside and mothership sectors must pay a 5 percent vessel buyback fee, which is 5 percent of the gross value of fish landed. Table 1 summarizes the fee information.

6. THE BENEFITS OF COOPERATIVE BEHAVIOR

6.1 Economic efficiency

Companies with more than one vessel immediately transferred excess capacity out of the fishery and only 7 of the 10 original vessels participated in the 1998 fishery. Each year since the implementation of the cooperative, the companies have employed less than the 10 permitted vessels. Before 1998, each company employed all their permitted vessels in order to catch fish as rapidly as possible. A high catch rate per unit time became a primary imperative. With the implementation of the cooperative, catch per unit time became less important, since each company could now plan its activities according to individual needs and opportunities. This included matching raw input product quality characteristics with output product forms and developing portfolios of products, including frozen block fillets, individual quick frozen fillets and surimi (Larkin, Sylvia and Tuininga, 2003).

Economic efficiency also increased in other ways. Under the cooperative agreement, companies were able to trade or lease quota. These trade provisions allowed vessels to lease quota from vessels that were less efficient or had other more profitable fishing and processing opportunities. In addition, under the cooperative agreement there is no set date when the vessels must begin fishing.² If a mechanical breakdown or other

² For the offshore sector, the beginning of the season had been changed by the PFMC from 15 April to 15 May in order to reduce salmon bycatch and allow Pacific whiting a chance to grow and recover from the rigors of spawning and migration. The on-shore sector opens their season even later, on 15 June. This date, however, is flexible and is determined based on a formula that accounts for seasonal improvements in product quality and recovery, harvest quota and processing capacity (PFMC, 1997; Larkin and Sylvia, 2004).

incident were to prevent a vessel from completing its normal fishing operations, the opportunity would not be lost. For example, under the race-for-the-resource in the mothership sector during the 1998 season, a mothership broke down for five days with resultant loss of \$500 000 in revenue (American Seafoods, 1998). Prior to the implementation of bycatch caps for the whiting fishery, which were implemented in 2005, vessels could fish for their quota at any time without the fear of being usurped by other vessels. In addition, firms have the ability to select optimal fishing conditions that depend on opportunities in other fisheries, fish size and quality, fish location, schooling characteristics and output market demand. In 1998, the season lasted 83 days, almost 60 days longer than previous years. Although not all boats were fishing during this entire time period, each company had the opportunity to adjust their operations to meet their respective needs.

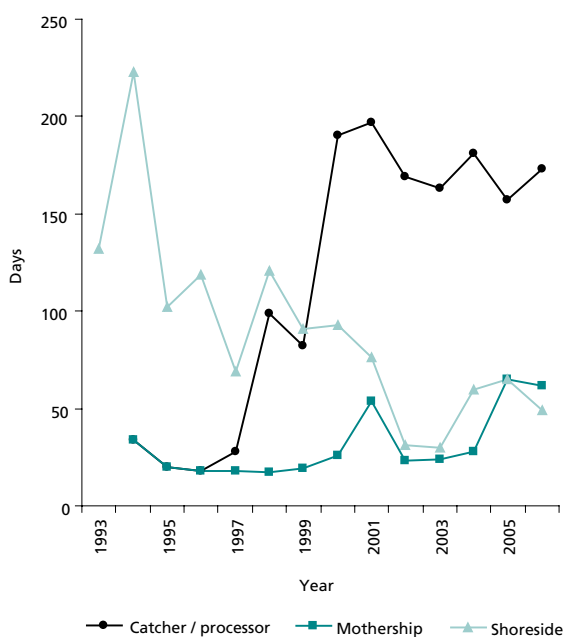
6.2 Increased product quality and recovery rates

The PWCC agreement also resulted in significant improvements in product recovery or yield, producing more food from each pound of fish landed. Product recovery rate or yield is the ratio (expressed as a percentage) of the weight of raw processed product relative to landed product. Prior to the formation of the cooperative, catcher-processors achieved on average a 17.2 percent yield in surimi operations. In 1998, the first full year under the harvest cooperative, catcher-processors were achieving an average yield of 24 percent. Based on 1998 landings, this equated to over 10 million more pounds of food from the same number of fish (ASPA, 2003). While engaged in the “race for fish,” vessels had prosecuted the fishery at the highest possible speed without taking the time to consider product quality or output quantity. Inferior quality and low product recovery rates were simply necessary trade-offs given the time constraints of a race-for-the-resource management system. Rationalizing the fishery allowed the vessels to prosecute the fishery at slower speeds and choose the time and location of fishing that would optimize returns. It allowed fishers to search for schools of larger and higher quality fish that generated higher yields than smaller fish (ASPA, 2003). It also motivated vessel owners to invest in equipment that would improve product yield and quality rather than simply maximize capacity for rapid throughput.

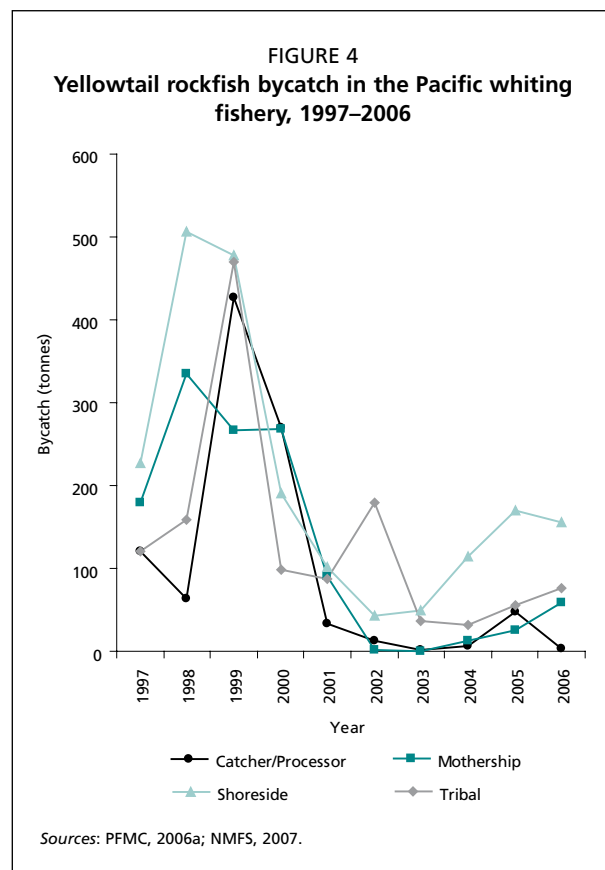
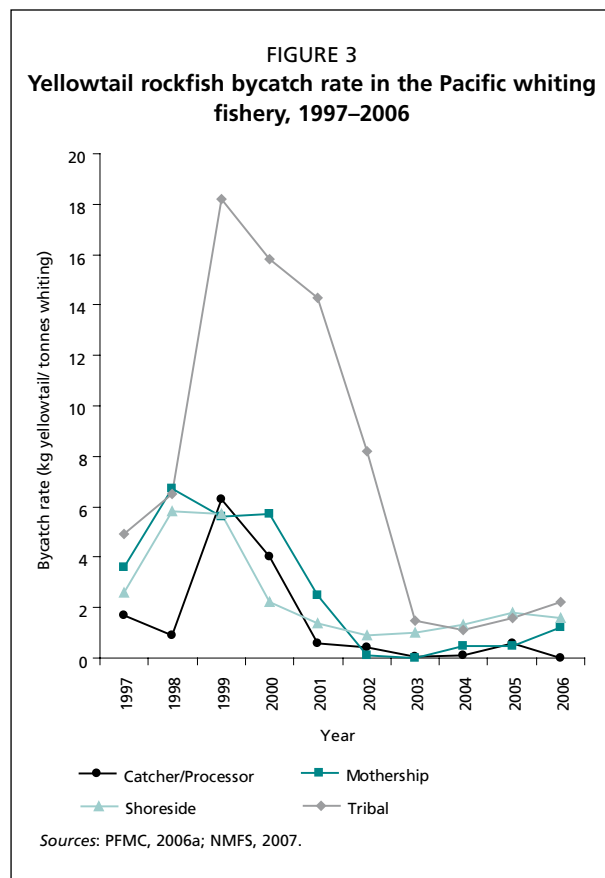
6.3 Season length increased

Season length had been dramatically reduced after the factory trawlers entered the fishery. Their ability to catch and process large amounts of whiting in a short period meant that the quota could be harvested in a period of weeks rather than months. Even after direct allocations were made to each sector, the race within each sector ensured that seasons would continue to contract. Following the implementation of the cooperative agreement in the catcher-processor sector, the season length increased significantly (Figure 2). Prior to 1998, the season for the at-sea sectors ranged between 18 and 34 days. During these derby fisheries, boats were fishing all day, everyday. Since the implementation of

FIGURE 2
Season length of the Pacific whiting fishery,
1993–2006



Sources: PFMC, 2002; ODFW, 2006; Renko, 2007; Federal Register, 2003, 2005, 2006a, 2006b



the cooperative, the average season length for the catcher-processor sector has ranged between 82 to 197 days. While the shoreside sector and mothership sector continue to race for fish, vessels in the rationalized catcher-processor sector have been able to slow the pace of harvesting and each firm now selects the most profitable period for participating in the fishery. In some years there have been breaks within the harvesting season of two or three months. In other years, such as 2003, some percentage of the catcher-processor's allocation was harvested in each month beginning 15 May and ending 24 October.

With increased season lengths and the elimination of the dangerous behavior of racing for fish, improvements have also been made in the areas of safety. Having the flexibility to choose when to fish allows companies the luxury of not fishing during extreme weather.

6.4 Reductions in bycatch

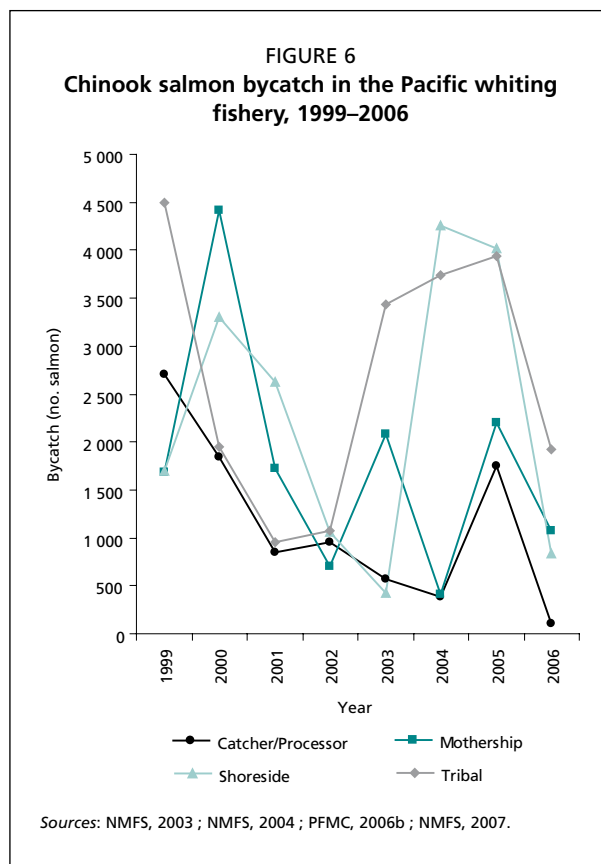
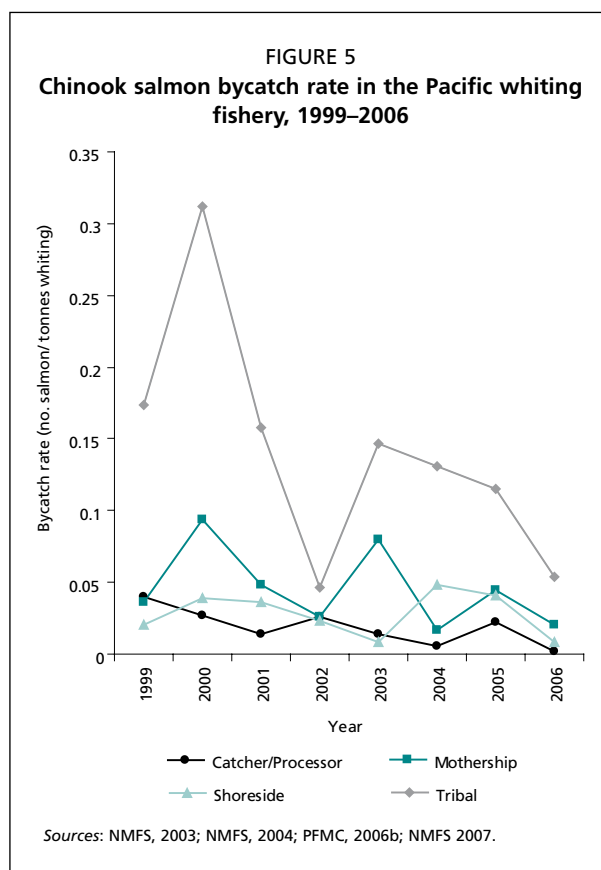
Another important issue related to establishment of the cooperative was the potential for reduction in bycatch of salmon and various rockfish species. Up through 2007, the PFMC has managed bycatch in the Pacific whiting fishery using enforceable aggregate caps across all sectors (rather than sector specific caps). Under cooperative management, vessels could take the time necessary to avoid areas of high concentrations of bycatch species and search for schools of Pacific whiting with a relatively lower mix of other species. Sea State monitors provide real time data to the catcher-processor vessels on "hot spots" (areas of high bycatch rates) so vessels can alter their fishing behaviour.

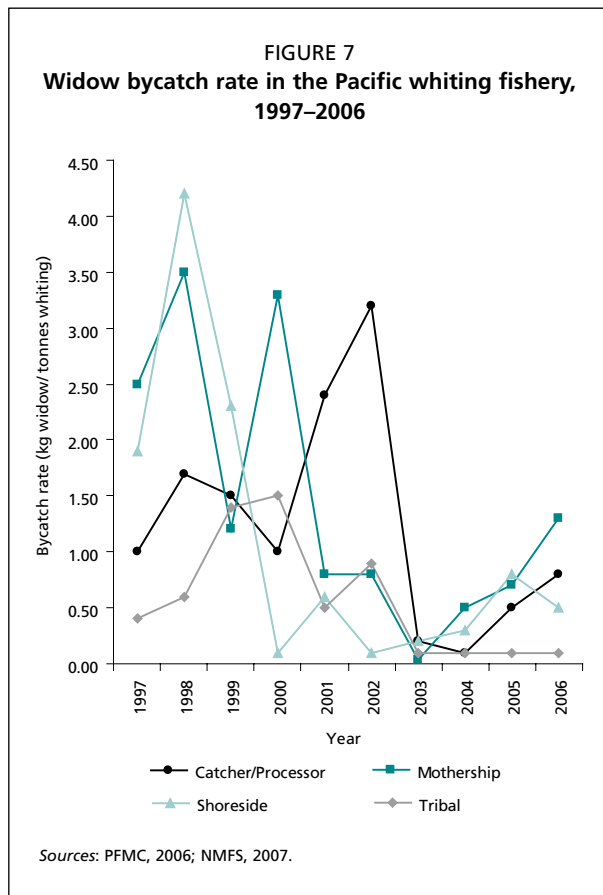
The evidence on bycatch reduction is ambiguous. While the bycatch rates have generally fallen under the PWCC, so have the bycatch rates for the mothership and shore-based fleet. The PWCC reports that the bycatch rate for yellowtail rockfish decreased by more than 60 percent from 2.47 kg of yellowtail rockfish a tonne of whiting under the race-for-fish to 0.96 kg a tonne under cooperative management (ASPA, 2003). Figures 3 and 4, however, show that the mothership and shore-based fleet have

also significantly reduced yellowtail bycatch since 1996. Figures 5 through 8 also show the same general trends for salmon and widow rockfish bycatch, respectively. Although the catcher processing fleet has a relatively low level of total bycatch relative to the other sectors, in 2001 and 2002 the catcher-processor fleet had the highest bycatch of widow rockfish relative to any sector of the fishery. Figures 9 and 10 demonstrate that all sectors of the fishery had reduced overall groundfish bycatch since 1998.

The factors influencing bycatch include: (a) the specific harvest practices of each sector; (b) the length, timing, location and depth of tows; (c) the relative proportion of stock size and harvest quotas of targeted and non-targeted species; (d) changes in stock migration patterns; and (e) regulatory or market forces influencing fleet targeting behaviour. This can lead to differences in bycatch rates across sectors and years. Due to improving ocean conditions, salmon populations have increased significantly over the last five years. Conversely, darkblotched, canary and widow rockfish have been declared as “overfished” species and have been placed under a rebuilding plan and significantly reduced harvest quotas.

In 2005, the Council implemented bycatch caps for depleted species in the non-tribal whiting fishery. This has compelled all sectors of the Pacific whiting fishery to reduce bycatch or face potential closures or other regulations controlling fishing behaviour. In 2007, the hard caps are set at 4.7 t for canary rockfish, 25 t for darkblotched rockfish and 220 t for widow rockfish (PFMC, 2006). If these caps are met or exceeded during the fishery by one or all of the sectors, the entire whiting fishery for all non-tribal sectors will be closed. If the whiting fishery is approaching the canary rockfish bycatch cap, the National Marine Fisheries Service may require participants to fish seaward of the 150-fathom isobath to prevent early closure of the whiting fishery. Also, the NMFS may take action to implement the Ocean Salmon Conservation Zone during the season if it is projected that non-tribal participants in the whiting fishery will take in excess of 11 000 Chinook salmon within





a calendar year. If this projection is made, fishing shoreward of the 100-fathom isobath can be prohibited.

All of the non-tribal sectors have met informally prior to and during the season to discuss bycatch issues and present solutions as bycatch issues arise. The different sectors of the Pacific whiting fishery have agreed to voluntarily cooperate to manage bycatch, particularly by sharing information. However, with (a) the implementation of binding bycatch caps in 2005, (b) the relatively small size of the caps, (c) the absence of sector specific caps and (d), the need to protect and rebuild a variety of rockfish and salmon stocks, the incentive for voluntary cooperation is reduced. Bycatch is expected to remain a critical and controversial problem for those stocks classified as depleted. Development of groundfish IFQ's or sector specific caps may provide more flexible approaches and effective incentives to manage this growing problem.

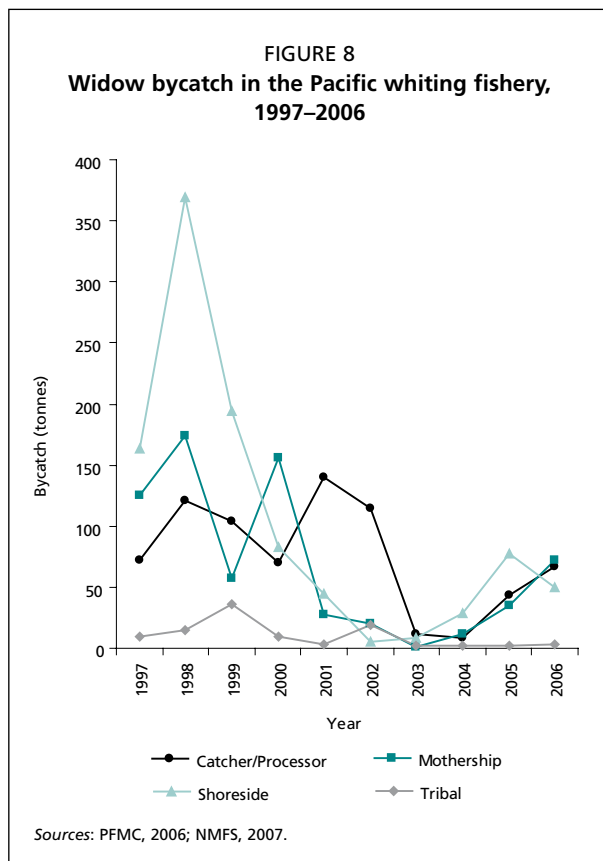
6.5 Cooperative research

Members of the PWCC have engaged in other activities to improve fishery management and scientific research (Sullivan, 2000). PWCC members are assessed a tonnage fee that is used to fund scientific research, including stock assessment and bycatch avoidance programmes. PWCC has worked cooperatively with the National Marine Fisheries Service in co-sponsoring a juvenile recruitment survey for Pacific whiting. In addition, the cooperative is a member of the Pacific Groundfish Conservation Trust, a non-profit research and education corporation focused on Pacific groundfish research. To date, PWCC members have assessed themselves almost \$1 million to fund cooperative research (ASPA, 2003).

7. DISCUSSION

7.1 Why only the catcher-processor sector?

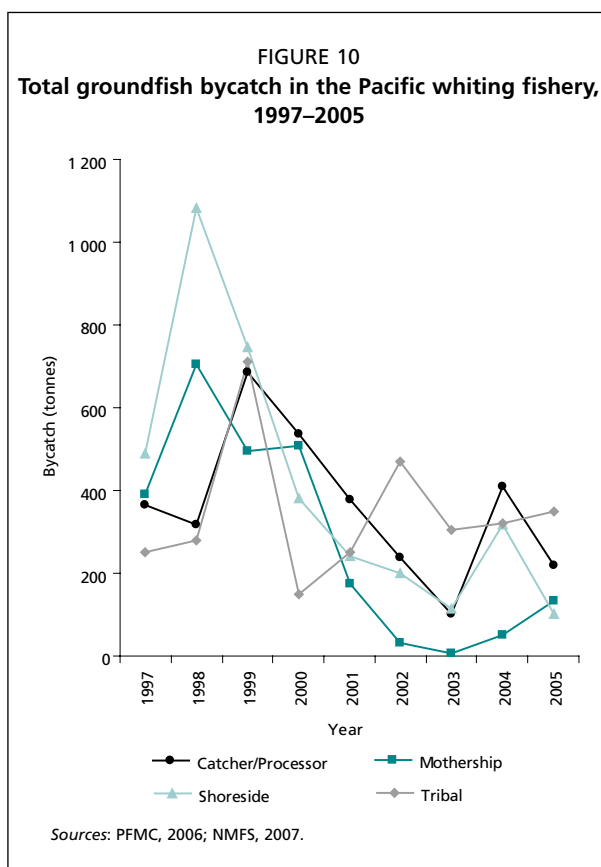
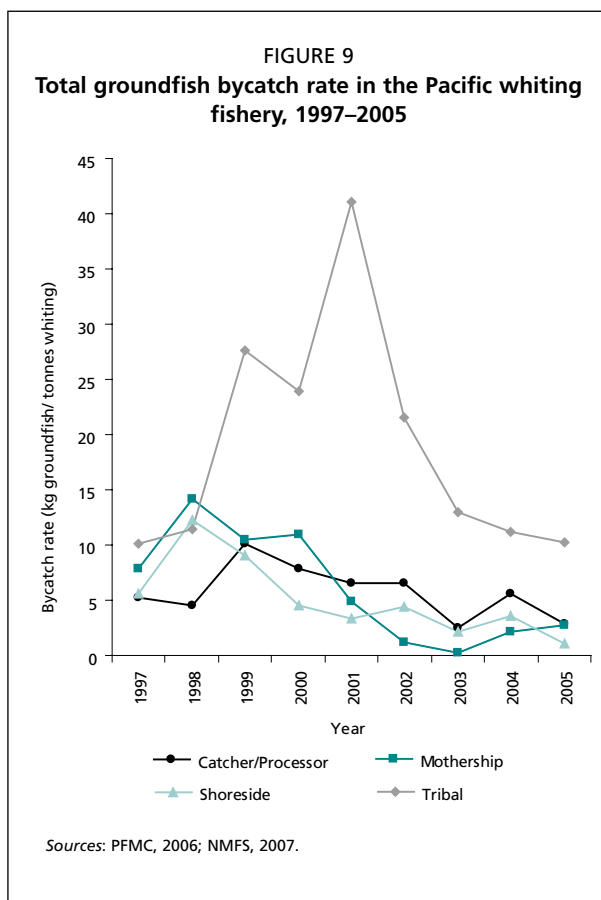
Forming the PWCC and rationalizing the catcher-processor sector of the Pacific whiting fishery generated significant benefits including greater economic efficiency, higher product recovery rates, improved product quality, greater potential control in managing bycatch



and longer and potentially safer seasons. A fundamental question is why didn't other sectors of the Pacific whiting fishery develop cooperatives or similar organizations in order to generate greater benefits?

The formation of the PWCC was attributable to a set of conditions necessary to support a formal cooperative arrangement. These factors include (a) a fixed set of players (licences), (b) a sector allocated right (a fixed percentage of annual harvests) and (c), a flexible right (an overall harvest quota that could be divided). However, these attributes also characterized the mothership and shore-side sectors of the whiting fishery. The single factor that differentiated the catcher-processor sector was the limited numbers of players. Not only were there few players (four companies), but the companies also had similar vertically integrated operations and good working relationships. In contrast, during 2006, 37 vessels and 12 seafood processors participated in the shore-side whiting fishery and approximately eight floating processors and 24 harvesting vessels in the mothership sector (Wiedoff, Conrad and Parker, 2003). The sheer number of players representing different two market levels (harvesters and processors) has made agreement extremely difficult. In addition, the harvest rights in these sectors are allocated only to vessels, not processors, further complicating efforts to reach agreement. While strides have been made in improving working relationships, the difficult regulatory environment has confounded efforts to improve cooperation. Consequently, for the last ten years these sectors have continued to engage in "irrational" competition and inefficient harvest and processing strategies that result in dissipation of economic and social benefits.

In 2003, the Pacific Fishery Management Council began a process to investigate individual fishing quotas (IFQ) for the groundfish trawl fleet, which includes the Pacific whiting fishery. Prior to 2003, any discussion of new IFQ programmes for federal fisheries was prohibited due to the moratorium on IFQ programmes. The moratorium has since been lifted and since 2004 the Council has undertaken a comprehensive effort to evaluate IFQs and



similar forms of rationalization for the groundfish trawl fleet. The trawl IFQ process has been cumbersome and complex and, even in 2007, several years are expected to pass prior to implementation of any programme.

7.2 Risks to the PWCC

The PWCC has been in existence since 1997, but recent problems have threatened its existence. The PWCC is a voluntary cooperative. If any member decided to terminate their agreement, the PWCC would crumble and return the sector to an Olympic fishery. There is also a risk of new entrants. The groundfish regulations would require a new entrant to purchase at least ten groundfish trawl permits at a cost of perhaps \$1 million or more. With recent price increases for whiting, the cost of entry seemed prohibitive. But, in late 2006, the *F.V. Starbound* did buy the necessary trawl permits with the intention to participate. Entry of the *F.V. Starbound* would change the dynamics of the fishery and probably result in the collapse of the PWCC, at least in its present form.

In late 2006 and early 2007, the Council forwarded recommendations to the National Marine Fisheries Service (NMFS) to implement an emergency rule prohibiting new entrants into the Pacific whiting fishery (PFMC, 2007). The original request for action came from the shoreside industry, which voiced concern over an influx of AFA-qualified vessels into the shoreside fishery. In simplified terms, AFA-qualified vessels are Alaskan pollock vessels that were covered by the *American Fisheries Act* [AFA]. The AFA delegated responsibility to the Pacific Council to develop management plans to control any negative impact that might result from fishing effort leaving a rationalized Alaskan pollock fishery and entering west coast fisheries. No action had been taken by the Council and AFA-qualified vessels without prior participation in the whiting fishery were indeed entering the fishery. A second concern was that increased pressure might be placed on depleted species such as canary rockfish. With more vessels entering the fishery, additional pressure on these depleted species might cause an early closure in the whiting fishery, prior to full harvest of the whiting quota.

Advocates contended that emergency action should be taken while Amendment 15 to the *Pacific Groundfish Fishery Management Plan* was completed and implemented. Amendment 15 is focused on implementing the mandates from AFA. The Council's first emergency rule recommendation, forwarded to NMFS in September of 2006, would have prohibited all AFA-qualified vessels that had not participated in the whiting fishery prior to 31 December 2005 from entering any non-tribal sector of the fishery. This rule was subsequently denied by the NMFS, because it discriminated between AFA and non-AFA vessels. The Council forwarded a second rule to the NMFS in March 2007 that would prohibit all vessels (regardless of AFA qualifications) who had not participated in the whiting fishery prior to 1 January 2007, from entering any sector of the non-tribal fishery. At the time this paper was written (2007), the NMFS had not taken action on the emergency rule request. If approved, this second emergency rule would prohibit the *F.V. Starbound* from participating in the fishery during 2007 and thus would prevent any disruption to the current make-up of the PWCC. If, however, the emergency rule is denied, the *F.V. Starbound* is poised to enter the at-sea sector of the fishery and would likely cause the dissolution of the PWCC and a return to a race for the resource situation in the catcher-processor sector.

A second possible risk to the PWCC is the establishment of an IFQ programme that would eliminate the primary purpose of the cooperative, to establish and allocate individual harvesting quotas. The degree of this threat may depend on how the IFQs are structured and how well initial issuance criteria match up with the historical allocations currently utilized by PWCC. However, even in the presence of an IFQ programme, the PWCC members may elect to continue the organization to facilitate cooperation in research and management, such as bycatch management. This is consistent with the

actions of many rights-based fisheries that form self-governing organizations in order to enhance the value of their fishery rights.

At present (2007) the Council is also considering co-operatives in lieu of ITQs for the three non-tribal sectors. This alternative could impose mandatory co-ops for the fishery. These cooperatives may be structured differently to the current PWCC agreements, as many more individuals, including the Council, NMFS and the public, will be involved in the decision as to how the co-ops are structured and would operate. This process could result in a framework that requires major changes to the current PWCC structure. The process could also involve much higher transactions costs, as more actors are involved in a more public process. This would be quite different from the process that the four companies completed in one afternoon in 1997.

8. CONCLUSION

The development of fishery property rights can result in greater economic efficiency and higher levels of private and public benefits. Achieving these benefits, however, also depends on the characteristics of the fishery. Given the limited and relatively weak form of property rights that characterized the Pacific whiting fishery, only the catcher-processor sector was able to capitalize on the sectoral-based quota rights. The other two sectors continued to engage in economically irrational competition and race-for-the-resource harvesting and processing strategies. In contrast, the catcher-processor sector formed the PWCC, a self-governing institution that ended the race-for-the-resource harvest strategies. Firms were able to meet their individual needs and eliminate over-capitalization, improve product recovery and product quality and manage bycatch. These benefits were the result of the unique conditions that characterized this sector and notably of the limited number of players with similar characteristics and good working relationships. Given their size and complexity, other sectors were unable to develop similar self-governing institutions. It will require more carefully structured and refined property rights (e.g. appropriately crafted ITQ's) before these sectors of the Pacific whiting fishery achieve the same level of performance and economic benefits. Although it is uncertain whether the PWCC in its present form will survive contemporary threats and challenges, by almost any standard the organization has been a successful model of voluntary self governance.

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