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Post-Rationalization Restructuring of Commercial Crew Member Opportunities in Bering Sea and Aleutian Island Crab Fisheries

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U.S. DEPARTMENT OF COMMERCE
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ERRATA

This errata provides a correction to page 14, line 27 which lists an estimate of "1026 positions". The correct value should be "876" and has been updated in this edition. This estimate was originally included in the text to reflect the contents of Table 4. However, Table 4 was updated from an earlier draft version of the report but the value in the text was inadvertently not updated to reflect the updated table. In the earlier draft version of Table 4, buyback vessels were (incorrectly) included in the calculations and the change in vessel participation used a shorter time window (2004/2005 to 2005/2006 vs. 2004/2005 to 2007/2008). The window of time was widened due to the availability of more recent data. Our analysis was broadened to include the new information presented in Tables 5, 6, 7, 8 and 9, which also include data through 2007/2008.

ABSTRACT

This report examines how employment opportunities for commercial fishing vessel crew members have changed in the BSAI crab fisheries following the implementation of a catch shares style of management system by the North Pacific Fishery Management Council. Based on hundreds of hours of ethnographic interviews with current and former crew members, captains, boat owners, processing plant employees, and other stakeholders, the analysis examines the effects of rationalization on many aspects of crew employment, including geographic distribution of jobs, the number of crew jobs available, the types of crew positions on a vessel, the decision making processes of potential crew job-seekers, the structure of compensation of crew, the effects of leased quota on crew compensation per unit of effort, the scheduling of deliveries to shore-based processing plants and the effects of local sources of alternative employment on crew. The conclusions regarding these aspects of crew of employment are followed by recommendations for further social science research on issues raised in this report.

CONTENTS

BACKGROUND AND PURPOSE

The purpose of this research is to understand how employment opportunities for commercial fishing vessel crew members have changed in the Bering Sea and Aleutian Island (BSAI) crab fisheries following the implementation of a quota-based management system by the North Pacific Fishery Management Council (NPFMC). The objectives of the Crab Rationalization Program (referred to herein as rationalization or the rationalization program) are to address conservation and management issues associated with the previous open access fishery, reduce bycatch and associated discard mortality, and increase the safety of crab fishermen by ending the race for fish.[1] In the environmental impact statement (EIS) produced by the National Marine Fisheries Service (NMFS) and NPFMC for the fishery management plan of BSAI king and Tanner crabs, a rationalization program is explained as "one that results in an allocation of labor and capital between fishing and other industries that maximizes the net value of production". It is further noted in the EIS that "because rationalization involves a total revamping of the way the fishery is run, its designers must be aware of the numerous economic, social, and environmental consequences that flow from the details of the program design" (EIS No. 040410:1-6).

This report transmits preliminary information to the NPFMC, its committees and stakeholders, and the public, about the findings of the research thus far in concert with the NPFMC 3-year review of the program. However, the research and this report are not officially part of the 3-year review as directed by the NPFMC. Funding for this research was provided by the NMFS Office of Science and Technology in 2007 as part of a wider effort to develop social information regarding commercial fishing vessel crews in the United States.

While planning and conducting this research we became aware of a number of research projects on related topics and have made efforts not to duplicate efforts or exhaust the same interview populations. Briefly, these complementary projects include:

- Research by the staff of the NPFMC for the mandatory 3-year review.
- Research by Dr. Michael Downs of EDAW for the 3-year review on the social impacts of the program on Alaska fishing communities.
- Research by Dr. Gunnar Knapp and Dr. Marie Lowe of the University of Alaska's Institute for Social and Economic Research on the economic and social impact of the program on communities in the Aleutians East Borough (Lowe and Knapp 2006).
- Research by Dr. Seth Macinko of the University of Rhode Island and funded by the North Pacific Research Board on the impacts of rationalization on BSAI crab crew with a focus on financial compensation using ethnographic interview techniques.

[1] See http://www.fakr.noaa.gov/sustainablefisheries/crab/rat/progfaq.htm#changes

- Research by Dr. Chang Seung of the Alaska Fisheries Science Center applying regional economic models to BSAI crab fisheries.
- Research by Dr. Amber Himes-Cornell of the Alaska Fisheries Science Center on the impacts of rationalization on vessel owners

In the interest of providing useful and meaningful research, we coordinated and consulted with each of these researchers either by telephone or in person. As a result of two other projects underway that focus on financial compensation to crew, we elected to de-emphasize that aspect of crew employment in our own research and focus more on social factors. As a result of two projects focusing on community impacts, we have also de-emphasized that in this work, focusing instead on crew members as an occupational community.

To focus on crew employment we analyzed information derived largely from ethnographic interviews to understand the impacts of rationalization in four categories: crew composition, employment opportunities, work characteristics, and alternative employment opportunities. A primary goal of eliciting this information was to scope a set of testable hypotheses that can be rigorously evaluated in the future to address what interviewees conveyed as the most salient and pressing issues concerning crew opportunities in the crab fisheries. Thus, the reported impacts perceived by individuals, conveyed to us through the interviews, and expressed in this report should be interpreted as a reflection of crew members' views about several aspects of the crab rationalization program rather than a final assessment of the program by the authors of this report.

METHODS

We used an ethnographic approach to our research. Ethnographic research engages fieldwork techniques to describe social and cultural meanings and activities from an insider's point of view as opposed to an outsider's perspective (Spradley 1979). The basic techniques applied are participant-observation and semi-structured in-person interviewing. Ethnographic approaches are particularly appropriate for small populations (for example, a village or a regional subgroup like BSAI crab crew members rather than a nation-state or a demographic category); for populations not likely to respond to surveys (because of, for example, issues with literacy, culture, technology, infrastructure, trust, etc., some of which are pertinent to BSAI crab crew); for populations that are difficult to randomly sample (because, for example, they are not enumerable or they tend to have transient residencies, both of which are true for BSAI crab crew); and for populations that are difficult to contact (again, relevant to BSAI crab crew). Ethnographic methods are particularly suited for research in which the goals include eliciting the voices of a particular population; for deriving ideas, testable hypotheses, and conclusions inductively from data and experience; for generating nuanced profiles of human practices; and for understanding social and cultural subjects for which the primary elements are not well understood.

The majority of the work for this project has been based on unstructured interviews or semi-structured interviews. Unstructured and semi-structured interviewing techniques are used in tandem to form the foundation of time-intensive ethnographic interviews (Bernard 2002:205). Such interview methods are designed to prescribe the general topic and then allow themes within that topic to emerge from the interview population. Interviews are then coded thematically and the themes are analyzed to construct an understanding of the topic from the perspective of the participants. One of the advantages of this ethnographic approach is that the specific research topics are not predetermined, but are elicited from the interview subjects themselves. It is not necessary to decide beforehand what elements of a social system are important, as it would be to formulate survey questions. Rather, the interview subjects are free to describe what is important to them within the research theme. This approach foregrounds the lived experiences of the study population and treats the participants as the true experts on their own experience.

One objective of ethnography is to allow the voices of research participants to speak for themselves. To this end, we have included many direct and paraphrased quotes in the text. We offer some attributes of the speaker to provide context, such as involvement capacity in the BSAI crab fisheries and residence. However, it should be carefully noted that the same sentiment may also have appeared in other interviews[2] and been expressed by people differently involved in fishing and residing in very different geographic areas. We therefore caution against concluding that a statement is necessarily representative of the type of interviewee, which was specifically not our intention. However, we generally use quotes to illustrate perspectives that were widely expressed by a variety of individuals. Thus, although a specific quote represents the singular perspective of an individual, we use quotes to illuminate topics that achieve broader importance when the data is considered in aggregate. Topics on which only a single individual expressed an opinion or described experience are generally not included in this report. Where something reported by only one individual is included in this report it is clearly indicated as such in the text (e.g., p. 24 on the origin of the "deck boss" position as a *Deadliest Catch* phenomenon). In the text, we use quotation marks to denote direct quotes; all others are paraphrased. Quotes are described by the place and status of interviewee, and the interview number. For example (former captain Seattle, No. 099) means that the interviewee was a former captain and the interview, number 99, was conducted in Seattle. We designate all interviews conducted with informants in Oregon communities by the state due to the small number of interviews conducted in some Oregon communities and the resulting potential for the individual to be identified.

[2] In some instances the same sentiment was expressed by a large number of individuals but to avoid redundancy and strive for parsimony in reporting we did not include successive, nearly identical comments in this report. Rather, we selected one or more quotes that encapsulate the thoughts on a topic and our accompanying text comments on the pervasiveness of those thoughts or feelings in the interviews to provide context.

Interview participants for this project were solicited by methods known as intercept sampling and snowball sampling of persons meeting the criteria for the project.[3] We sought to include informants who had participated in BSAI crab fisheries before and/or after rationalization (or both) as crew members , but also included skippers/captains, vessel owners, and processing plant employees (processing plant managers were contacted in each field site and most agreed to an interview) in the sample frame. Intercept sampling refers to contacting participants in places where persons meeting the interview criteria are likely to be found. In this project, this included docks, supply stores, fishermen's typical meeting places, and organized conferences and meetings. Snowball sampling refers to meeting key people (for example through intercept sampling) who then connect researchers to others who may be relevant and willing to contribute to the research project (Bernard 2002). In this way, contacts were sought and made through local crewmen's groups and fishing associations. In addition to intercept and snowball sampling, we also solicited participation by posting notices on bulletin boards at community centers and commercial fishing docks in field work locations (locations are discussed in more detail below).

Before entering a fieldwork location, we contacted stakeholders who we could identify remotely, such as processing plant managers, harbor masters, and community managers and leaders. Interviews were scheduled when those contacted were amenable, and were conducted at the beginning of each field work period. From these interviews, suggestions for other research participants were elicited. In our interviews with plant managers, we explained the project methods and goals, and to requested permission to walk the docks looking for crew members to interview. In all cases, permission was granted and delivery schedules were provided to facilitate contacting crab vessels. The next stage of fieldwork involved contacting people, especially crew members, who we could not identify prior to entering the field site. The primary method entailed walking the docks and explaining the project to crab captains and crew members and soliciting their participation. If they agreed to participate, interviews were either conducted immediately, or a meeting place and time was scheduled for the interview at the convenience of the interviewee.

In numerous cases, people interviewed had and shared contact information for other individuals either currently or formerly employed as BSAI crab crew. Thus, these contacts were achieved through a social network that coincidentally seemed to mimic that often utilized by many captains and crew to contact and hire crew members when positions arise (details on the role of social networks are described further in a subsequent section of the report). A few interviews were conducted by phone, and all such interviewees had been identified through social networks. As mentioned we also made concerted efforts to elicit participation through attending meetings and informal gatherings of crab crew members and other stakeholders where we introduced the project and requested voluntary and confidential participation. In addition, we received several responses to notices posted in places frequented by crab crew, such as the Fishermen's Terminal and LFS Marine Supplies store in Seattle, WA. Thus, sampling "on the ground"

[3] Crew population data from which a sample could have been drawn from data held by the PSMFC was not available due to confidentiality restrictions. The sampling approach used instead was determined to be the best available option.

consisted primarily of three methods: 1) contact over the phone with stakeholders in the field site, 2) walking the docks and attending gatherings, and 3) advertising the project and requesting participation in on community boards in strategic locations.

We were aware of several vessel owners' groups that also could have been used to track down additional crew members, but it was determined that such a "top-down" approach may have compromised the confidentiality we felt was essential for crew members to speak openly about their work experiences and opportunities. Given the hierarchy that exists among owners, captains, and crew, and potential repercussions that could be anticipated by crew for participating in such a study (especially if the sentiments of the crew differ widely from those expressed by the other parties), we felt that a "bottom-up" approach would provide more candid responses.

All types of sampling present the challenge of overcoming sample bias. Sample bias occurs when a non-random sample or an imperfect random sample is not representative of the population it purports to represent. Randomness in sampling is not an end in itself but a means to achieving representativity, which may be attained through other means. In this project we pursued representativity by seeking breadth of sample – a wide variety of participants from different categories of participation in the occupational community from a variety of geographies. Although the ethnographic approach used does not purport to be statistically representative of the entire desired population, it attempts to represent a reasonable portion of that population. Interviews were conducted with former and current crew, captains, and others with varying extents of involvement in the BSAI crab fisheries and holding a diverse array of opinions about the crab rationalization program. Thus, as displayed in the tables below, even without a statistically representative sample, this project has benefited from the involvement of all different categories of crew that may represent unique perspectives. Again, we want to emphasize that our priority was to contact current and former crew members. While this does include both captains and deckhands, we distinguished between these categories and prioritized the latter. In our sampling techniques we avoided contacting boat or quota owners or captains who could lead us to crew members, favoring instead a "bottom-up" up approach of contacting crew, deckhands, directly to address concerns that "top down" approaches might bias the sample toward those crewman whose views were more similar to those of captains and owners.

Nonetheless, several sources of potential sample bias should be recognized. Some segments of the population remain underrepresented in the interviews despite our attempts to seek them out. For example, it has been much more difficult than anticipated to find crew who are no longer in the crab fishery, despite many efforts. As one current crew member put it, "We don't see the guys who lost jobs, they just disappeared." (crew, Seattle, No. 074). An additional source of potential sample bias is geographic, in that only six major locations were pursued while there are actually hundreds of locations in Alaska and elsewhere that currently supply, or historically supplied, crew to the fishery.

Even if solicitation of interviews is broadly representative, it does not mean that agreement of participation is representative. As one potential snowball sampler put it,

"But you know, even if I give them your number, they'll be like 'blaahhhh' [waves hand]. They're fishermen, they don't like to talk. What good will it do?" (Seattle, crew, 037). Although we did find the vast majority of stakeholders willing to talk with us, once they agreed to participate, a few people found it difficult to discuss something about which they feel sensitive. For example, one crewmember who is no longer able to find a position in the BSAI crab fisheries explained that "he feels stupid" that he cannot find work in the fisheries and that because he feels it is his own fault, he has a hard time talking about it (former captain, Seattle, No. 083).

Fieldwork Locations

Field research was conducted in Alaska, Washington, and Oregon, the three states supplying the vast majority of vessels in the fishery. The purpose of going to field locations was to interview people who met the project criteria for interviews, rather than for direct observation of the fisheries. Field research consisted of visiting communities involved in the crab fisheries and interviewing current and former participants in BSAI crab. Interviews took place on docks, on board vessels, at processors, in local cafes, at public meetings, and by telephone. Our fieldwork did not include observing actual crab harvesting. Table 1 contains the locations and dates of fieldwork.

Table 1.-- Locations and dates of project fieldwork.

State	City	Dates
AK	Dutch Harbor	6 – 12 October 2007; 24-25, 31January 2008
AK	Kodiak	12,15-18 October 2007
AK	Akutan	25-30 January 2008
AK	Old Harbor	13-15 October 2007
OR	Astoria/Warrenton	May 31-June 1, 2008
WA	Seattle area	April 15 – June 30, 2008

In addition to interviews, fieldwork involved attending the Kodiak Fisheries Advisory meeting on 18 October 2007, the February 2008 NPFMC meeting in Seattle, the 28 February 2008 Pacific Northwest Crab Industry Advisory Committee meeting in Seattle, and visiting docks and shipyards in Washington, Oregon, and Alaska.

Interviews

A total of 90 interviews with 134 individuals (five people were interviewed more than once and several interviews included more than one participant) were conducted. The interviews were distributed between locations in Alaska, Washington, and Oregon(see Table 2). More than half of interviewees were current BSAI crab fishery participants. The rest included former BSAI crab fishery participants and other stakeholders (see Table 3

for more details). The distribution of interviews by location, participant category and interview type is disclosed in more detail below.

The majority of interviews were conducted in person. Six phone interviews were conducted from the Alaska Fisheries Science Center in Seattle when an in-person meeting was not feasible. Of the 90 total interviews, 38 were relatively in-depth, lasting up to an hour or more and yielding particularly detailed information.

Interview refusals, in which a person was asked to participate but declined to do so, were very few. In general, the vast majority of people agreed to participate. Only one person actively refused while several others did so indirectly ("come back at another time" or "leave your number and I'll call") and might have been included had they been pursued under a different type of sampling strategy. In one case, the captain intervened and refused on behalf of the crew members. There were a few interviews in which the participant either directly or indirectly indicated a wish to keep participation confidential, but the vast majority of interviewees were not uncomfortable disclosing their participation. Nonetheless, we have obscured all identities in the materials presented here, identifying individuals only by their category of participation (e.g., ex-crab crew) and occasionally by location.

Interviews followed a semi-structured format that involves guided questioning as well as allowing for topics that are salient to the interviewee to be explored. Semi-structured interviewing was determined to be the most appropriate technique for collecting information on general parameters of change within the BSAI crab fisheries as well as details on more specific, individual experiences of fishery participants. All interviews with current or former participants in the fishery covered topics such as personal histories, including how people entered the crab fishery, other fisheries or industries in which they have participated, and how long they have been fishing in a BSAI crab fishery and other fisheries.

Interviews addressed how current and former positions were obtained, the length of time a crew member had held a current position, and whether or not they intended to remain in the position. Interviews also covered crew members' sense of job satisfaction, what other activities they engaged in throughout the year, and their longer term vision for their career. If amenable, interviewees were asked about their past and present financial status and assets. Interviews with processing plant employees and other stakeholders were more specific to the role that person held in relation to the BSAI crab fishery and were geared to elicit information on how they perceived changes in the fishery since 2004.

Interviews with current and former crew and skippers covered the hiring process, opportunities and opportunity costs in the fishery, and decision making regarding participation in the fishery. To elicit information on changes associated with the crab rationalization program, we asked about any perceived changes in the fishery following rationalization, including questions that allowed us to later make comparison between the decades prior to rationalization and more recent experiences since the first rationalized season in 2005. Crew experience levels, compensation issues, and future expectations

were covered. Because the semi-structured interview process allows the interviewee to guide the specific topical foci of an interview within the selected theme, participants were free to elaborate on the topics they found most relevant. As a result, two major effects of rationalization as experienced by crewmen ─longer seasons and quota leases─ dominated the unstructured portion of most interviews.

Interviews by Location

The majority of interviews were conducted in Alaska, although many of these participants reside in other locations such as Seattle. Fieldwork in Alaska allowed us a certain proximity to the fishing grounds that facilitated contacting and interviewing crew members. We designate the location of the interview according to the location of the informant at the time of the interview which may be different from their place of residence or from the location of the researcher in the case of interviews conducted over the phone (Table 2). Several interviews involved more than one interviewee. Four people were interviewed twice, and one person was interviewed three different times for follow-up information.

Table 2. -- Number of people interviewed at each location.

Location	Number of People Interviewed
Dutch Harbor	69
Akutan	23
Kodiak	17
Old Harbor	1
Seattle	24
Astoria/Warrenton	4
Other Alaska locations	2
Total people interviewed	134

Interviews by Participant Category

We interviewed people involved directly or indirectly in various capacities in the BSAI crab fisheries. We sought to interview persons who had participated in BSAI crab fisheries before or after rationalization (or both) as a crew member, skipper/captain, vessel owner, processing employee or other stakeholder, with an emphasis on including those participating as crew members (Table 3). Crew members with a variety of experience levels were interviewed, ranging from aspiring crew who had not yet been hired on a crab vessel but did have previous fishing experience to veterans of the industry, retired skippers, and boat owners with over 50 years of experience.

Of 134 individuals interviewed, only 24 were persons who could be considered to have left or lost their positions in BSAI crab fisheries in the post-rationalization restructuring.

This represented just 18% of the total number of individuals interviewed, but nearly one quarter of the total number of captains and crew interviewed. We anticipated a larger number of former crew participants in the project but, as mentioned, we had difficulty locating people in this category. In the words of a former crew member, "We don't even have any proof that they, crew, you know, exist. They are a band of gypsies united by what they do" (former crew, Kodiak, No. 031). Consequently, we may not have captured the full range of perspectives from former crewmembers who are no longer in the BSAI crab fisheries. We are therefore more limited in what we can say about what former crew are doing and how current circumstances compare to their time participating in the BSAI crab fisheries. We recognize that this means that the report reflects more of a view of the fishery held by those who have not been displaced. We encourage additional fieldwork that targets this elusive group. For those we located, the response rate (agreement to be interviewed) was similar to that of current fishery participants.

Table 3. -- Number of people interviewed by participant category.

Crab crew	64
Former crab crew	20
Crab captain	12
Former crab captain	6
Non-crab crew/captain (fishermen who never participated in BSAI crab fisheries)	6
Crab boat owners	5
Processing plant employees	8
Community members and other stakeholders	13
Total unique individuals	134

We recognize that there may be other or underrepresented categories due to our sampling methodologies in spite of our efforts to be broadly representative.

ANALYSIS OF INTERVIEW DATA AND CREW INFORMATION

The analysis of data from the ethnographic interviewing for this project and other available sources of information on the topic of post-rationalization restructuring of crew opportunities generated four main topical areas: 1) composition of crew (geographic distribution and numbers of crew, types of positions, and demographic characteristics); 2) employment opportunities (including hiring processes, qualifications, unfilled positions, c-shares, and job-seeker decision processes); 3) work characteristics (including pay structure, time inputs, compensation per unit effort, delivery schedules, and safety); and 4) alternative employment opportunities (including multi-industry and multi-fishery strategies, and geographic influences). Each topic is considered comparatively, as

appropriate, in terms of crew perceptions of pre-rationalization conditions relative to post-rationalization conditions.[4]

Composition of BSAI Crab Crew

The composition of BSAI crab crew can be considered in several different ways. Below, we analyze information regarding changes in the total number of vessels participating by geographic distribution of residence, discuss how vessel participation pertains to crew participation, discuss the type of positions designated on a vessel, and present some demographic information on crew. The approach of analyzing crew composition through vessel activities is necessitated by pre-existing shortcomings in data on individual crew members and is elaborated further below.

Vessel Participation by Geographic Distribution

According to data contained in Alaska Department of Fish and Game (ADF&G) fish tickets, the number of unique vessels participating in BSAI crab fisheries dropped from 256[5] in 2004/2005 to 101 in 2005/2006, 91 in 2006/2007, and 87 in 2007/2008. This concentration led to a significant drop in crew participation in the fisheries. Ideally, this study could have presented details on changes in crew participation and demographics by fishery, and shown the areas in which current and former crab crew reside, but as discussed further below, available data are limited to conduct such analyses. The economic data reports (EDR) collected for BSAI crab fisheries contain some relevant information on crew employment and residence (among other things) in BSAI crab fisheries,[6] but the pre-rationalization data are not detailed enough to facilitate a comparison of how the composition of crew residence changed after the program was implemented. The ethnographic interviews we conducted captured demographic data, but did not cover enough of the pre- and post-rationalization population for a sufficient geographic analysis. ADF&G crew license data, which also contain information about crew residences, cannot be sorted by fishery and thus information specific to BSAI crab crew cannot be selected. As indicated in interview data discussed in more detail below, it appears that crab vessels often hire crew in the home locations of the vessels, more than at crab ports or through advertising. Thus, the geographic distributions of vessel ownership and gear operator residence before and after rationalization were used as proxies for the geographic distribution of crew position loss.

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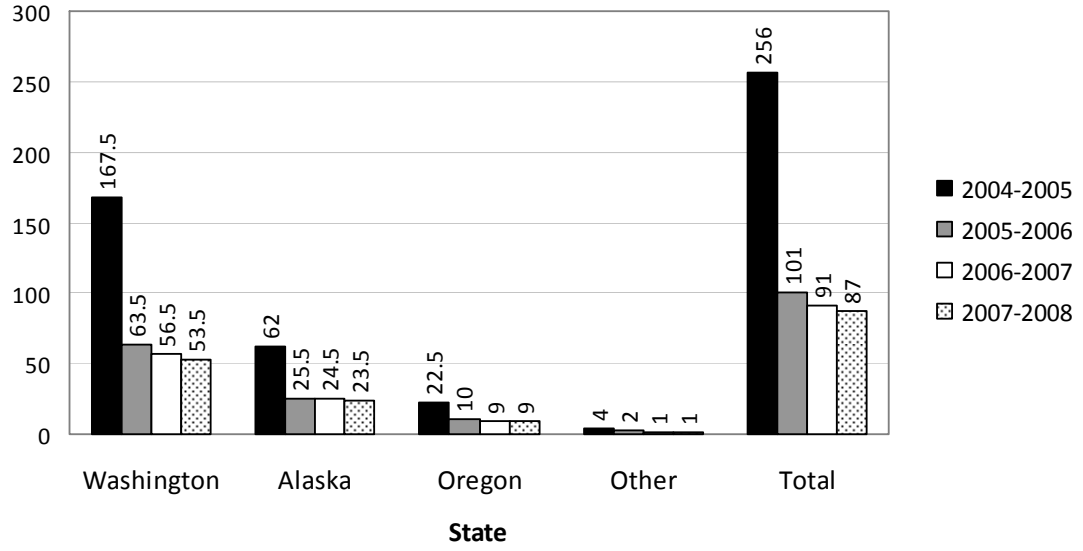
[4] The focus of this preliminary report is crew employment. Information relevant to other sectors and aspects of BSAI crab rationalization is not presented or analyzed here, but may be the subject of subsequent articles and reports.

[5] This number includes 23 vessels that participated in the crab buyback program.

[6] More detailed information has been collected using unique crew identifiers (commercial crew license numbers or commercial gear operator permit numbers) in the post-rationalization period. The 2005 data on crew identifiers suffered from data quality issues, but since that time it has improved considerably. Less detailed, historical information was collected in 2005 for the years 1998, 2001, and 2004 on the location of residence for crew members, but data quality documentation suggests those location data may be incomplete.

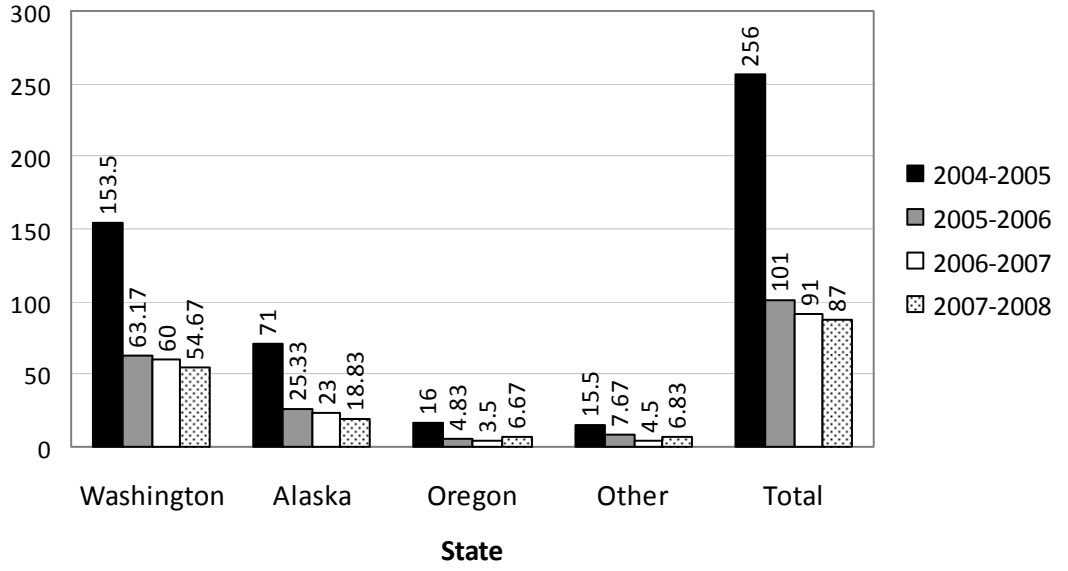
Nearly all of the vessels (98-99%) that have participated in the BSAI fisheries both before and after rationalization are registered to owners who reside in three states: Alaska, Washington, and Oregon. Figure 1 shows changes in the geographic distribution of vessel ownership in the BSAI crab fleet between 2004/2005 and 2007/2008, indicating how crew who are residents of these states may have been differentially displaced by jobs lost on boats that no longer participate in the crab fisheries.

Similarly, Alaska, Washington, and Oregon account, both before and after rationalization, for almost all (92%-95%) vessels fishing in the BSAI crab fisheries when using gear operator residence as a proxy for geographic distribution. Figure 2 shows 2004/2005 to 2007/2008 changes in the geographic distribution of the fleet by BSAI crab gear operator residence.



*** 2004/2005 figures include 23 vessels that participated in the crab buyback program. States are counted fractionally in instances where the vessel changed ownership within the season and consequently had more than one state of ownership for that season.**

Figure 1.-- Unique vessels participating in BSAI crab fisheries between 2004/2005 and 2007/2008, by owner's state of residence.

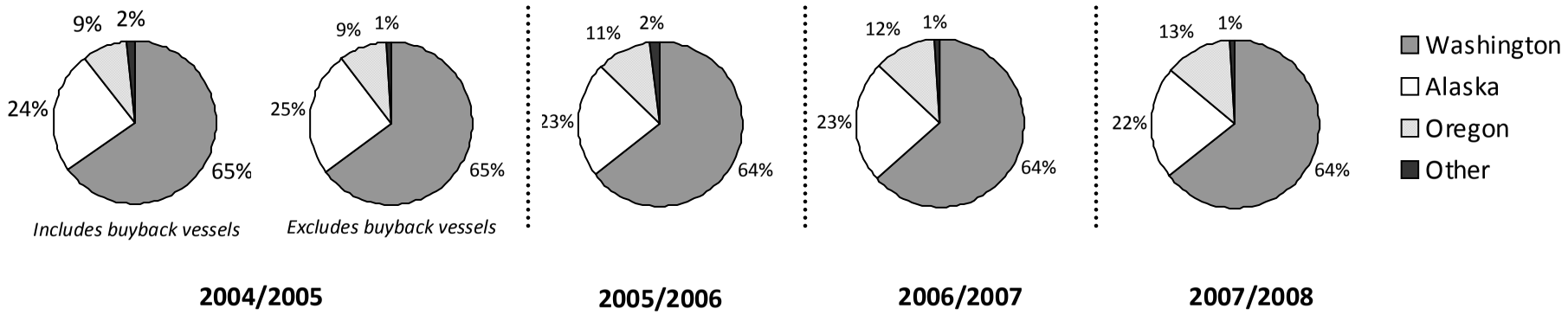


*** 2004/2005 figures include 23 vessels that participated in the crab buyback program. States are counted fractionally in instances where the vessel has two or more BSAI crab gear operators reporting different states of residence.**

Figure 2.-- Unique vessels participating in BSAI crab fisheries between 2004/2005 and 2007/2008, by gear operator's state of residence.

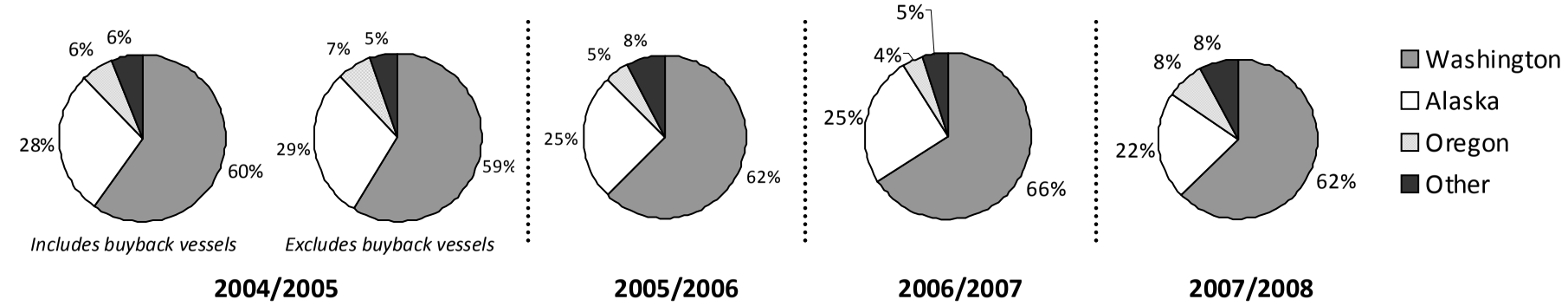
Our research results indicate the primary importance of social networks in crew recruitment and employment processes. Consequently, we reach the tentative conclusion that in general, much crew hiring is done where the vessel, and likely the captain, are based.[7] Thus, position loss would likely be high where vessel numbers are high. Figures 1 and 2 show that the largest concentration of vessels and thus probably the largest concentration of crew jobs, both available and eliminated, are based in Washington state. The Seattle area in particular likely absorbed the highest number of crewmen losing their positions (Lewis 2005). As discussed more in sections below, the residence of a displaced crewman has a strong effect on alternative employment opportunities. Proportionately, however, as shown in Figures 3 and 4, the post-rationalization geographic distributions of vessel participation in BSAI crab fisheries, and thus likely of crew opportunities, remains very similar to the pre-rationalization distributions. The implication is that crew job losses were not disproportionately distributed between the states relative to the pre-existing *distribution* of participation. The distributional effects may be different in the disaggregated view by fishery, and we recommend this as a topic for further research.

[7] The accuracy of this assumption can be investigated when vessel ownership and gear operator data are compared with EDR records on crew location of residence.



*States are counted fractionally in instances where the vessel changed ownership within the season and consequently had more than one state of ownership for that season.

Figure 3. -- Proportion of BSAI crab vessels by state of owner residence, 2004/2005 – 2007/2008.



* States are counted fractionally in instances where the vessel had two or more BSAI crab gear operators reporting different states of residence.

Figure 4. -- Proportion of BSAI crab vessels by state of gear operator permit holder residence, 2004/2006 – 2007/2008.

Numbers of Crew Participating in Crab Fisheries Before and After Rationalization

The rationalization program was designed in part to address the overcapitalization of the BSAI crab fleet by providing incentives to consolidate fishing effort on fewer vessels. Job loss for crewmen was predicted to be a significant impact of the rationalization program due to processes of fleet consolidation (EIS No. 040410). Unfortunately, the data available to address the potential transition of crew in and out of the BSAI crab fisheries, or into other endeavors, is quite limited. Specifically, because there is no system to track crew participation by individuals across all fisheries (as we can with vessels), we cannot define the set of individuals that participated in BSAI crab before rationalization and specify whether they are still fishing in crab, have moved on to other fishery or tendering activities, or left the industry entirely.

If we cannot accurately and directly address these specific issues of interest, it may be possible to utilize other sources of available data on vessel participation across fisheries and reasonable assumptions about crewmembers to approximate the impacts on crew participation (a "second-best" approach). Although such an approach appears to be a logical and potentially fruitful way to utilize existing data, the range of assumptions regarding crewmember participation can generate drastically different estimates of crew impacts.

Table 4[8] provides an example of how large differences can arise in estimates of crab crew positions lost through the following discussion by using two different methods that use different assumptions to calculate the changes in available crew positions. Method A takes the number of unique vessels participating in any BSAI crab fishery multiplied by the Alaska Department of Labor estimate of six crew positions per vessel.[9] The result of 876 positions lost would correspond to the number of persons displaced from the crab fisheries if each vessel kept the same individual crew members for all crab fisheries throughout the year.

[8] This table was excluded from some previous drafts of this report which were made available to the public; however, it has been reinserted here upon the specific instruction of the Scientific and Statistical Committee of the NPFMC.

[9] The Alaska Department of Labor creates employment estimates by combining landing records attached to a fishing permit with the results of an ongoing survey of permit holders. "Crew factors" quantify the labor needed to fish a specific permit given gear type and regional specifications. Crew factor estimates may be conservative since they do not account for shipyard work nor do they capture individual cases when a crew member may leave prior to landings being made (Patton and Robinson 2006:12-13). In our calculations we assume that one permit will be associated with one vessel (as indicated on the Alaska Commercial Fisheries Entry Commission permit application forms), therefore allowing us to calculate positions by vessel.

Table 4.--Vessel counts, estimated ex-vessel revenue, and estimated crew positions in all BSAI crab fisheries before (2004/2005) and after (2007/2008) rationalization (source: ADF&G fish tickets). [10,11]

	Notes	2004/2005	2007 ($k, 2004 dollars)	Change
Unique vessels in BSAI crab fisheries fleet	Vessel counted only once no matter how many distinct fisheries participated in	256-23 vessels from buyback = 233	87	-146 vessels
Vessels fishing in aggregated BSAI crab fisheries	Vessel counted repeatedly for each fishery participated in	443-25 vessels from buyback = 418	196	-222 vessels
Pounds	Total of all BSAI crab fisheries	45 million - 2 million from buyback vessels = 43 million	90 million	+47 million lbs
Ex-vessel value (2004 dollars)	Estimated from ADF&G and CFEC data	131 million - 8 million from buyback vessels = 123 million	188 million	+$64 million
Crew positions method A	# unique vessels x AKDOL estimate of 6 positions per vessel	1536 - 138 from buyback vessels = 1398	522	-876 positions
Crew positions method B	# vessels in each BSAI crab fishery x AKDOL estimate of 6 positions per vessel	2658 - 150 from buyback vessels = 2508	1,176	-1332 positions

[10] We have collated available fish ticket data from all BSAI crab fisheries. This data represents Bristol Bay red king crab, Bering Sea snow crab, western and eastern Aleutian golden king crab, and western and eastern Bering Sea Tanner crab. We do recognize the complexity of vessel involvement in different fisheries, and that crew positions associated with vessels that are able to fish in multiple fisheries will have been affected differently than vessels that rely solely on a handful of fisheries such as the Bering Sea opilio and pot cod, and salmon tendering.

[11] A total of 25 vessels were removed from the BSAI crab fisheries through a federal buyback program, with 23 of these participating in crab in the 2004/2005 season. In order to show changes in fishery statistics that are attributable to rationalization, we have calculated 2004/2005 figures without these 23 buyback vessels.

Method B takes the aggregated number of vessels participating in each BSAI crab fishery multiplied by the Alaska Department of Labor estimate of 6 crew positions per vessel. In other words, vessels may be counted two or more times if they participated in more than one fishery, such as red king crab and opilio crab. The result of 1,332 positions lost would correspond to the number of persons displaced from crab fishing if each vessel hired a completely different crew for each fishery in which it participated, which is possible but not likely, based on ethnographic evidence. This estimate could be considered to be near the upper bound on the maximum number of individuals affected, given that the usual rate of in-season turnover has not been determined. This rate is unknown, but would raise the maximum number of individuals affected.

There are even more ways one could frame the question to generate different crew impact estimates. The crew participation changes calculated by Lowe and Knapp (2006) of 1,350, which does not account for buyback effects, is slightly above the estimate derived using Method B above. However, all of these estimates are markedly different from those derived by Arni Thomson of the Alaska Crab Coalition (ACC). These estimates were prepared in a document given to the NPFMC on February 6, 2007 regarding Agenda Item D-2(c), entitled "Alaska Crab Coalition (ACC) Analysis of Harvesting Jobs By Homeport of Bering Sea Crab Vessels". The ACC has analyzed this issue in terms of *jobs lost for the entire year in all fisheries* and has a much lower estimate, asserting that 108 jobs were lost due to consolidation in red king crab. These calculations assume that if a vessel which left the crab fisheries remained active in another endeavor, that the same crew were employed and thus no jobs were lost. Unfortunately, sufficient data on crew participation data do not exist to test this assumption. Regardless, the reader should understand that the disparity between the ACC job number estimates and the participation number estimates referenced here and in Lowe and Knapp (2006) arise because they are fundamentally different concepts resting on different assumptions.

Factors that Offset the Loss of Crew Positions

Numerous factors offset the impact of consolidation and loss of crew positions. These include the prospects of better income for remaining vessels, including their crew, the ability for exiting vessels to participate in other Alaska fishing activities, including tendering, and efficiency gains that result in lower costs overall for prosecuting the fishery. Other factors that offset impacts of consolidation appear to primarily benefit categories of participants other than hired crew. These include generating additional income from the leasing of in initial issuance quota and the sale of initial issuance quota.

Pre- and post-rationalization fishing activities among vessels that left the crab fisheries -- Whether or not a job aboard the vessel is truly "lost", the economic impact of leaving the crab fishery depends upon whether the crew income that was formerly derived in crab (and any other activities in which they participated aboard the vessel) differs significantly from the crew income earned in the vessels' post-

rationalization activities (assuming that same crew is utilized). Following up on the ACC assertion that vessels that left the crab fisheries are still actively employed elsewhere, we examined the vessels[12] that left both the snow and red king crab fisheries in 2005-2006 to see the extent to which they continued to participate in other fisheries and had relied upon non-crab based fishing before and after rationalization. [13,14] We found support for the idea that exiting vessels participate in other fisheries off Alaska but there is no way at this time to test for the continuity of individual crew members on those vessels. It is also possible that vessels participated in other West Coast fisheries that are not showing up in this analysis; to this end, the Alaska Fisheries Science Center is initiating research to examine multi-regional fishing strategies for the West Coast and North Pacific fisheries. To examine the substitution of income from other fisheries off Alaska, we used ADF&G fish ticket data to compare pre- and post-rationalization participation and ex-vessel revenues in Alaska commercial fisheries for two categories[15] of catcher vessels:

- "double exiters," or vessels that fished both Bering Sea snow crab (BSS) and Bristol Bay red king crab (BBR) in 2004/2005, the last crab season before rationalization, and did not participate in either fishery in the 2005/2006, 2006/2007, and 2007/2008 seasons.

- "single exiters," or vessels whose participation in BSAI crab in 2004/2005 was limited to Bristol Bay red king crab and who did not participate in this fishery in the 2005/2006, 2006/2007, and 2007/2008 seasons.

As seen in Figures 5 and 6, which show the proportion of vessels participating in fisheries off Alaska in 0, 1-2, and 3 post-rationalization seasons, single and double exiters differed in their rates of continued participation in Alaska commercial fisheries after rationalization. Of 62 double exiters, 45 made no landings in fisheries off Alaska in any of the first 3 seasons of rationalization, 9 made landings in 1 or 2 seasons, and 8 made

[12] Catcher processors were excluded from this analysis given that the number of such vessels that left crab is relatively small and their fishing activity in federal fisheries in the North Pacific may not be fully accounted for in Alaska fish tickets.

[13] There are data available to compare the landings revenues formerly earned in crab with the landing revenues from current fishery activities, but income earned in tendering cannot be accounted for in such an analysis and thus income estimates may be incomplete. In addition, one cannot empirically test or corroborate, from available data, the assumption that the former crab crew members are participating in other current fishing activities.

[14] We have not accounted for revenue generated from leasing out of quota by vessel owners who historically fished crab on their own boats but have chosen in the post-rationalization period not to participate in the crab fisheries. Revenue from leasing out quota has likely helped vessel owners in offsetting the general decline in ex-vessel revenue. Nevertheless, because such revenues typically flow to vessel owners only, we do not consider quota leases to be a source of income for crew members on boats that ceased participation in the crab fisheries after rationalization.

[15] These two categories exclude any vessels that participated in at least one crab fishing season after rationalization. Given that vessels may sit out one or more crab seasons but return to fishing crab in a subsequent season, we choose to use non-participation in the first three seasons of rationalization as a strong indicator that a vessel has permanently exited the crab fishery. Note that this methodology accounts for the seeming discrepancy between Table 4 and Tables 5 and 6 in the numbers of vessels that "left" crab fishing.

landings in all 3 seasons. A significantly higher rate of post-rationalization participation in fisheries off Alaska is seen among the 46 single exiters: 6 made no post-rationalization landings in the first 3 seasons, 2 made landings in 1 or 2 seasons, and 38 made landings in all 3 seasons. Crew members that stayed with vessels that continued fishing in Alaska after rationalization thus had access to other fishing opportunities that presumably helped offset income lost from leaving crab. It should be noted that we did not have access to leasing revenue data which would have offset any impacts to quota owners. The Alaska Fisheries Science Center is initiating research to examine the impacts of rationalization on vessel owners. This research could illuminate the role of leasing revenues in offsetting other impacts.

Tables 5 and 6, which show 2004/2005 ex-vessel revenues by seasons of post-rationalization participation in AK fisheries, suggest that for both categories of vessels, specialization in crab relative to other fisheries off Alaska in 2004/2005 is a strong inverse indicator of continued post-rationalization participation in other fisheries off Alaska. For the 45 double exiters and 6 single exiters that made no post-rationalization landings, the mean percent of revenue derived from crab in fisheries off Alaska in the 2004/2005 season was 98% and 97%, respectively, which contrasts with the respective figures of 55% and 15% for double and single exiters that made landings in each of the first 3 seasons of rationalization. Thus vessels which were highly specialized in BSAI crab before rationalization were more likely to leave fisheries off Alaska altogether than those which were less specialized before rationalization.

Among double exiters, the geographic distribution of vessels, as indicated by the state of residence associated with the CFEC gear operator permit, that continued to participate in fisheries off Alaska post-rationalization differed considerably from the geographic distribution of all double exiters pre-rationalization. Table 7 indicates that the number of Alaska and non-Alaska vessels fishing off Alaska decreased disproportionately after rationalization: while Alaska vessel numbers fell from 18 to 7 (a decline of 61%), non-Alaska vessels fell from 44 to 5 (a decline of 89%). Assuming that these geographic distributions reflect crew location, the participation figures in Table 7 suggest that among double exiters, Alaska fishing opportunities for non-Alaska crew decreased more (in both relative and absolute terms) than for Alaska crew.

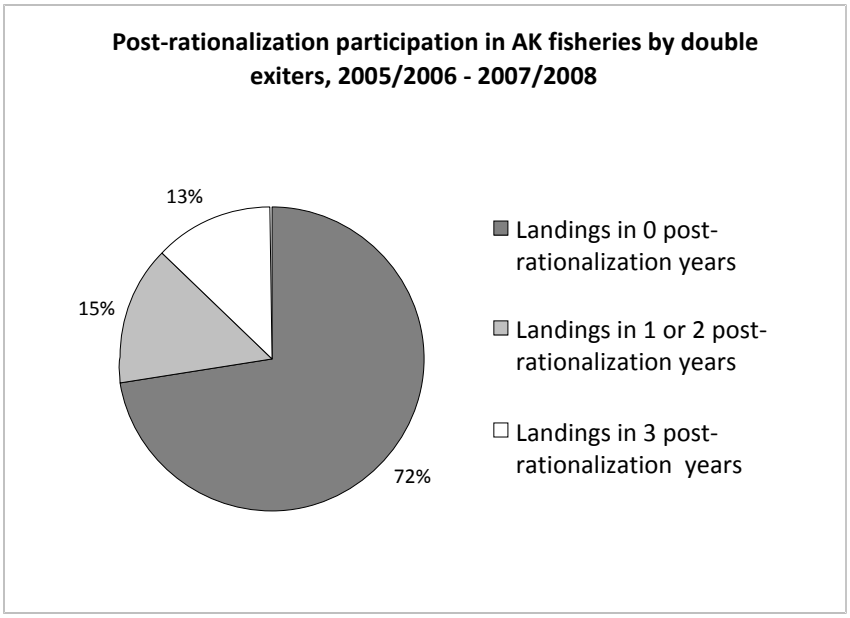


Figure 5.-- Post-rationalization participation in AK fisheries by DOUBLE exiters, 2005/2006 – 2007/2008.

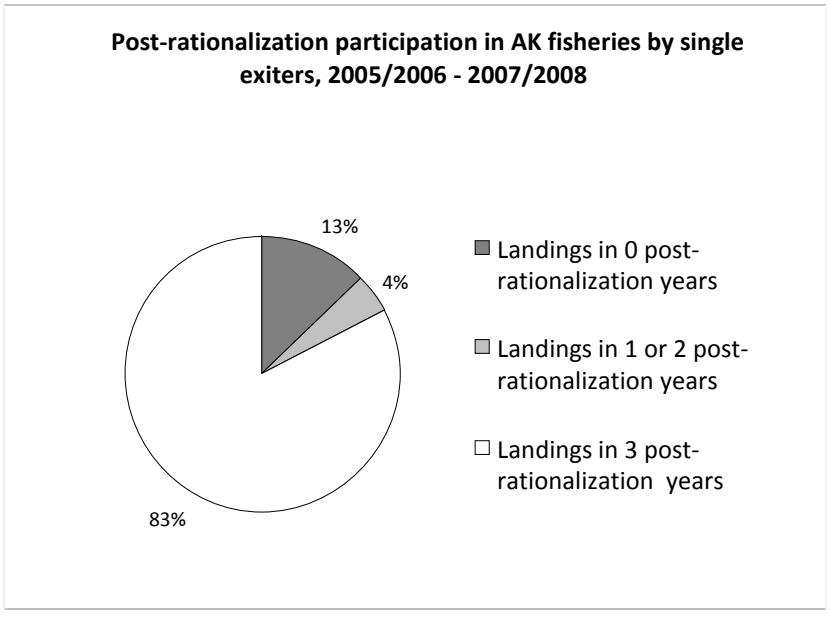


Figure 6.-- Post-rationalization participation in AK fisheries by SINGLE exiters, 2005/2006 – 2007/2008.

Table 5. -- DOUBLE exiters' 2004/2005 AK fishery revenue by level of post-rationalization participation in AK fisheries.

Number of post-rationalization years with AK fishery landings

Number of post-rationalization years with AK fishery landings	*Number of vessels*	**2004/2005 AK fisheries ex-vessel revenue ($k, 2004 dollars)**			
		% of total AK fishing revenue from crab		**Total AK fishing ex-vessel revenue**	
		MEAN % of total fishing revenue from crab	***MEDIAN % of total fishing revenue from crab***	***MEAN ex-vessel revenue***	***MEDIAN ex-vessel revenue***
Landings in 0 post-rationalization years	45	98%	100%	$535	$460
Landings in 1 or 2 post-rationalization years	9	91%	100%	$620	$476
Landings in 3 post-rationalization years	8	55%	52%	$1,194	$980
Total	**62**				

Table 6. -- SINGLE exiters' 2004/2005 AK fishery revenue by level of post-rationalization participation in AK fisheries.

Number of post-rationalization years with AK fishery landings

Number of post-rationalization years with AK fishery landings	*Number of vessels*	**2004/2005 AK fisheries ex-vessel revenue ($k, 2004 dollars)**			
		% of total AK fishing revenue from BBR crab		**Total AK fishing ex-vessel revenue**	
		MEAN % of total fishing revenue from crab	***MEDIAN % of total fishing revenue from crab***	***MEAN ex-vessel revenue***	***MEDIAN ex-vessel revenue***
Landings in 0 post-rationalization years	6	97%	100%	confidential*	confidential*
Landings in 1 or 2 post-rationalization years	2	26%	12%	confidential*	confidential*
Landings in 3 post-rationalization years	38	15%	11%	$1,755	$1,929
Total	**46**				

*These figures are confidential due to aggregate 2004/2005 data shown in Table 8.

Table 7. -- Change in AK fishery ex-vessel revenues by DOUBLE exiters, by year of post-rationalization fishery participation.

Double exiters with landings in AK fisheries by season of participation (AK, WA, and other states)*	**Baseline year - 2004/2005 AK fisheries ex-vessel revenue ($k, 2004 dollars)**		**2005/2006 AK fisheries ex-vessel revenue ($k, 2004 dollars)**		**2006/2007 AK fisheries ex-vessel revenue ($k, 2004 dollars)**		**2007/2008 AK fisheries ex-vessel revenue ($k, 2004 dollars)**	
	04/05 baseline MEAN for vessels in column 1	*04/05 baseline MEDIAN for vessels in column 1*	*MEAN, (% change from 04/05) for vessels in column 1*	*MEDIAN, (% change from 04/05) for vessels in column 1*	*MEAN, (% change from 04/05) for vessels in column 1*	*MEDIAN, (% change from 04/05) for vessels in column 1*	*MEAN, (% change from 04/05) for vessels in column 1*	*MEDIAN, (% change from 04/05) for vessels in column 1*
2004/2005: 62 (18, 36, 8)	$620	$476	--	--	--	--	--	--
2005/2006: 12 (7, 3.5, 1.5)	$1,014	$811	$661 (-35%)	$405 (-50%)	--	--	--	--
2006/2007: 12 (7, 2.5, 2.5)	$948	$695	--	--	$647 (-32%)	$325 (-53%)		
2007/2008: 11 (7.5, 2, 1.5)	$981	$658	--	--	--	--	$821 (-16%)	$416 (-37%)

*Numbers in parentheses indicate number of vessels with gear operators reporting residence in a) Alaska, b) Washington, and c) other states. Vessels are counted fractionally for each state in which its gear operators report residence for that particular season. For example, a vessel that has two gear operators reporting Alaska residence and one gear operator reporting Washington residence is counted 0.5 times for Alaska and 0.5 times for Washington.

Table 8. -- Change in AK fishery ex-vessel revenues by SINGLE exiters, by year of post-rationalization fishery participation.

Single exiters with landings in AK fisheries by season of participation (AK, WA, and other states)*	**Baseline year - 2004/2005 AK fisheries ex-vessel revenue ($k, 2004 dollars)**		**2005/2006 AK fisheries ex-vessel revenue ($k, 2004 dollars)**		**2006/2007 AK fisheries ex-vessel revenue ($k, 2004 dollars)**		**2007/2008 AK fisheries ex-vessel revenue ($k, 2004 dollars)**	
	04/05 baseline MEAN for vessels in column 1	*04/05 baseline MEDIAN for vessels in column 1*	*MEAN, (% change from 04/05) for vessels in column 1*	*MEDIAN, (% change from 04/05) for vessels in column 1*	*MEAN, (% change from 04/05) for vessels in column 1*	*MEDIAN, (% change from 04/05) for vessels in column 1*	*MEAN, (% change from 04/05) for vessels in column 1*	*MEDIAN, (% change from 04/05) for vessels in column 1*
2004/2005: 46 (16.83, 20.83, 8.33)	$1,513	$1,459	--	--	--	--	--	--
2005/2006: 40 (15.33, 16.33, 8.33)	$1,709	$1,767	$1593 (-7%)	$1645 (-7%)	--	--	--	--
2006/2007: 38 (13.5, 16.5, 8)	$1,755	$1,929	--	--	$1794 (2%)	$1877 (-3%)	--	--
2007/2008: 38 (12.83, 17.33, 7.83)	$1,755	$1,929	--	--	--	--	$1565 (-11%)	$1751 (-9%)

* See footnote for Table 7

In Tables 5 through 8, it should be noted that the effects of any decline in vessel revenue would be mitigated for quota share holders by additional revenue generated by the sale of or leasing fees on initial issuance quota shares. These revenues are not included in Tables 5-8. In addition, not shown in Tables 5-8 are improvements in revenues achieved by vessels that continued their participation in BSAI crab fisheries.
In terms of earnings from non-crab fishing opportunities, both single and double exiters with continued participation in fisheries off Alaska saw overall declines in total ex-vessel revenue relative to 2004/2005 levels. Table 7 shows that the mean (nominal) ex-vessel revenue for the 12 double exiters with Alaska landings in 2005/2006 represented a decline of 35% from the mean ex-vessel revenue for these same 12 vessels in 2004/2005; and median ex-vessel revenue declined by 50% in this first season. The 11 double exiters fishing in the 2007/2008 season fared better, with their 2007/2008 mean revenue representing a 16% decline from 2004/2005. Single exiters who continued fishing in other fisheries off Alaska generally fared better than double exiters in recovering revenues lost from exiting crab. Table 8 indicates that the 40 single exiters that fished in 2005/2006 had a mean ex-vessel revenue 7% lower than their 2004/2005 mean ex-vessel revenue. The 2006/2007 and 2007/2008 seasons saw participation by the same set of 38 single exiters. Mean ex-vessel revenue for the 38 vessels participating in these two seasons represented, respectively, an increase of 2% and a decrease of 11% from 2004/2005. It should again be noted that losses in ex-vessel revenue do not equate to similarly sized losses in profit, as costs are incurred in generated landing revenues.

Tendering is another activity in which vessels may participate to offset income that had formerly been earned in crab fishing. As shown in Table 9, 15 of 62 double exiters participated in tendering in the 07/08 season, an increase from the baseline figure of 8 double exiters that tendered in 2004/2005. Note that only 4 of the 8 vessels tendering in 2004/2005 tendered in 2007/2008. Also confounding this trend is data indicating that only 1 vessel in 05/06 and 2 vessels in 07/08 participated in tendering.

Table 9.-- Tendering by double and single exiters, 2004/2005 – 2007/2008.

	2004-2005	***2005-2006***	***2006-2007***	***2007-2008***
Double exiters				
Number of vessels involved in tendering	8	1	2	15
Total pounds (K) tendered	3,201	confidential	confidential	20,706
Mean pounds (K) tendered	400	confidential	confidential	1,380
Single exiters				
Number of vessels involved in tendering	1	2	2	4
Total pounds (K) tendered	confidential	confidential	confidential	confidential
Mean pounds (K) tendered	confidential	confidential	confidential	confidential

Ultimately, we do not know whether the same crew that participated in the crab fisheries on a given vessel are still fishing aboard the same vessel in other fisheries/endeavors, are fishing aboard another vessel, or have left fishing entirely. Our ethnographic data indicate that this kind of year-long vessel fidelity is present for some vessels but is not the most common pattern among crew. In fact, the pre-rationalization frenzied tempo of the race for fish was particularly attractive to crew who were looking for a short time-investment as a key element of supporting other annual income-producing activities. Our interview data suggest that some former crab crew members (particularly those from the Seattle area), have left the fishing industry altogether, while others either continue to, or have begun to, participate in other fisheries. Thus, there is evidence to both support and reject the assumptions employed in both potential methodologies discussed above.

As a result of the issues outlined herein, it is clear that at this time we cannot provide accurate estimates of the number of individuals who lost crew jobs due to the consolidation associated with rationalization. It is also clear that there are several ways to frame questions related to crew impacts that generate markedly different estimates.

Types of Crew Positions on a Vessel

Based on the information provided in ethnographic interviews, the types of crew positions on a vessel have not changed with rationalization. The basic categories of position continue to include captains (or skippers) and deckhands, and deckhands include greenhorns, engineers, and other sub-types such as deck boss. Our interviews do suggest, however, that there may have been changes in the numbers of certain types of crew, the qualifications of individuals filling the positions, and ways in which they earn compensation.

Captains -- Captains or skippers[16] run the vessel. There is one captain per vessel and there may be a relief captain who can stand in as needed. The captain decides where to fish (sometimes in consultation with the vessel owner), when to fish (within regulation seasons and in coordination with processing plants), oversees the preparation and post-season care of the vessel, hires and directs the deckhands, and runs the wheelhouse. At sea, the captain is in charge of everything and all authority to act flows from his command. Knowledge and judgment are among the most important inputs captains provide to the fishing operation.

Captains must hold an appropriate State of Alaska Gear Operators Permit (GOP) and this number is recorded on fish tickets at the time of delivery. To fish as a captain in a cooperative in the rationalized fishery, a captain must have the hired master classification. BSAI crab captains are usually hired by the vessel owner, which may be an individual, company, or community development quota (CDQ) group. Captains often have a long history with a boat or a company, usually working their way up to the position, and often having close relationships with the owners of the boats. An average experience is reported in interview notes from one such captain as follows: After being

[16] Although some sources may differentiate captains from skippers in terms of licenses held or vessel ownership, we use them interchangeably in this report.

with the company since 1984, he began to run the boat as a relief skipper in 1991 and in 1995 was hired as a skipper full time (captain, Dutch Harbor, No. 004). All the captains interviewed for this project appeared to be white and male and this seems to be representative of the group demographics as a whole.

Captains are compensated in different arrangements depending on their relationship to the vessel owner, their level of experience, and their ownership of C-shares (see below). In most cases, their compensation is proportional to the revenue earned by the vessel. Only captains, and not other hired crew, were eligible for C-shares in the initial allocation of BSAI crab quota and holding C-shares may increase captains' compensation significantly.

Deckhands -- Deckhands carry out the hands-on activities of fishing and running the vessel. A vessel typically has 4-8 deckhands who are on call 24 hours a day at sea, and typically work 12-20 hours at a time. Different tasks are associated with different types of deckhands, although there is a great deal of malleability according to skill, conditions, and the traditions of a particular vessel. Greenhorns, a term used to describe first season or early career crew, typically carry out the least desirable jobs, such as baiting the pots. Other routine tasks including cooking may revolve among crew or be designated to an individual for the length of the season. Engineers oversee the mechanical integrity of the vessel. If a deckboss is designated, he is a senior deckhand who will supervise the crew on deck for all activities, including pot pulling, sorting, cleaning, etc. Some vessels do not designate a deckboss, and at least one interviewee claimed that the position, or at least the label, was pushed by the producers of the Discovery Channel's Deadliest Catch television show for their own purposes (crew, Dutch Harbor, No. 008) and is not an emic category.

Deckhands in the BSAI crab fisheries who do not have a State of Alaska GOP in another fishery are required to have a State of Alaska Commercial Fishing Vessel Crewmember License, which costs slightly less for Alaska residents than it does for nonresidents. These licenses are readily available at fishing ports throughout Alaska and may be purchased online through the ADF&G. Crew licenses are not fishery specific and are not a way to link crew members to specific fishery participation. Unlike the State of Alaska GOP, crew license numbers are not recorded on fish tickets at the time of delivery. Engineers may hold special licenses, but these are not required. An analysis of aggregated Alaska commercial fishing vessel crew license data for all Alaska fisheries from 1993-2003 (Carothers and Sepez 2005) is available on the Internet at ftp://ftp.afsc.noaa.gov/posters/pCarothers01_comm-fish-crew-demographics.pdf.

In the BSAI crab fisheries, deckhands are almost always compensated in terms of crew shares. Crew shares are calculated at the end of a season based on a percentage of the vessel's net revenue, which is defined as total landing revenues less any costs that are shared among the crew and vessel. The shared costs that come "off the top" of the landings revenue when calculating share payments differ by vessel, but can include fuel, bait, groceries, taxes, individual fishing quota (IFQ) or CDQ leasing fees, among other things. Individual crew share sizes differ according to one's experience and crew position

and are denoted in fractions of a full crew share. Fractions we encountered during interviews included ½ share, ¾ share, full share and 1 ¼ share. Experienced crewmen are unlikely to work for less than a full share, while greenhorns can expect a half share, although there is no set progression. As one captain describes it: "The shares are along a continuum between ½ and full share crew. It's arbitrary but we recognize experience and also provide extra incentives as bonus to reward guys. There is also room for people to negotiate" (captain, Seattle, No. 082).

However, more important to overall compensation than the fraction of crew share is the percentage of vessel net revenue a full share represents. Evidence from participants in this research suggests a typical full crew share is between 4% and 7% of ex-vessel net revenue. The range of crew shares can be corroborated more definitively through the EDR database in the future.

Demographic Characteristics of Crew

There is no reliable source of data on the basic demographic characteristics (age, gender, ethnicity, etc.) of BSAI crab crew members. The majority of interview subjects were working-age white males, and this appears to reflect the majority of participation in the fishery, with additional participation by Alaska Native, Latino and Pacific Islander males. While it was discussed that the conditions of the post-rationalization fishery could, in theory, increase participation by foreign nationals, there was no evidence to suggest this was happening. The demographic subject most raised by interviewees was the issue of age, although there was no consensus on the direction of impacts. A majority perceived that crew were getting older. A few informants connected that shift directly to rationalization because of both the diminished opportunity to enter the fishery – and diminished attractiveness – for younger people, as well as because of the ability to fish at a slower pace, as evidenced in these interview quotes:

- I see older crabbers now. Young people don't think there is opportunity in the fishery to start at the bottom and work their way up, and don't think they want to work in jobs like this (displays his grease-blackened hands and fingers) (captain, Seattle, No. 075).
- "I know I am making more money now. And you don't have to be 19 years old anymore. We've got old guys now" (captain, Dutch Harbor, No. 004).
- "I'm not seeing a new generation here….the tide has shifted" (former captain, Kodiak, No. 079).
- "There's no confidence in the fishery with young people. There's no future in the industry for young people" (crew, Seattle, No. 066).
- "I'm not seeing a lot of young guys trying to get into the crab industry right now. I think the word is getting out that you can support a family. I am optimistic" (boat owner, Kodiak, No. 088).
- "The hardest thing to do is get young people to work and save at the shipyard. Even at the John Deere store, it's all old guys there too" (former captain, Kodiak, No. 079).

However, some participants recognized the critical role of young men in the fishery, implying that younger entry level persons would continue to be hired, and even favored in the hiring process:

- "When you look at the majority of the crab fishermen out here it's like these older guys' generation….You don't see many kids my age out here. I have a handful of friends that are doing it. So when these guys all retire, who's gonna do it? I don't know. The fishery's gonna become more dangerous [because people have less skill] (crew, Akutan, No. 051).
- "This is my 25th year fishing with these [boat owners] so I want to hire someone who will stay for 20 years. A younger guy has that going for him and the positions that open are usually more physical, climbing pots etc" (captain, Seattle, No. 087).
- "It's a young man's fishery: You have to be agile, quick and take a real good whack now and then" (community member, Dutch Harbor, No. 007).

Clear demographic data on crew members is necessary to track this trend. This data could potentially be generated by cross-tabulating information on individual crew in the EDR reports with the ADF&G crewmember license data. However, analysis of all commercial fishing vessel crewmember licenses in Alaska from 1993-2003 (Carothers and Sepez 2005) indicates a slight upward trend over the decade of approximately one year on a mean age of 30.2 years old. Any increasing age trend in crab crew data must be examined in comparison to this broader trend before it can be considered to be an effect of rationalization.

Employment Opportunities

Hiring processes under the post-rationalization BSAI crab fisheries appear to have remained similar to those used prior to rationalization, although they are now manifested under new conditions and terms of employment. Captains largely control hiring decisions and social networks are the predominant factor in hiring. Many crew members are hired that have some connection to a current crew member, the captain, or an owner. Experience on other vessels and in other fisheries is valued, although having worked for too many vessels is seen as a negative, indicating the inability to keep a position by performing well, or being too opportunistic. There are still opportunities for greenhorns on nearly every vessel. We were unable to quantify or compare the background rate of turnover in individuals filling crew positions.

Hiring Process

Captains are usually in charge of hiring. One Seattle based boat owner says "I hire and fire skippers and I give them a lot of rope to hire their crew" (owner, Seattle, No. 084). On the other hand, this was not universally true. A Kodiak-based vessel owner who

asserts that "[hiring] is the difficult part of the industry" does it himself (captain, Seattle, No. 088). Crew on boats owned by large companies may be hired through corporate procedures. According to a captain of a boat owned by Trident Seafoods, the crew hiring process was done entirely through the company. The captain himself did not have a hand in the process (captain, Akutan, No. 055).

Word of mouth and reputation are used by both skippers looking to make a hire and also by people who are looking for a crew job. The vast majority of current crew interviewed said they got their current and past positions through word of mouth or a social connection through friends or family. Many made the connection through participation in another fishery, particularly salmon. The following selection of quotes and interview notes illustrates the point:

- "Who you know – it's completely about that. Especially now because it's an even smaller market with fewer jobs but not fewer people looking" (former captain, Kodiak, No. 079).
- A crew member got the job because of a connection made when he was fishing salmon. Has been with this boat owner, but on another boat, for 10 years [his entire crab fishing career] (crew, Dutch Harbor, No. 059).
- "I've always done business through social networks" [i.e., got jobs and hired crews] (captain, Seattle, No. 082).
- "You can get a job if you know somebody…there's real tight nepotism" (crew, Oregon, No. 077).
- "It shouldn't be based on networks, or friends [but it is]" (former crew, Dutch Harbor, No. 019).
- A former crew got his first job when he would meet people who became friends when they came to deliver landings to processors on which he was working. He is still friends with these people (former crew, Akutan, No. 046).

In hiring decisions by captains, reputation of the job-seeker is paramount. Captains will check with their own social networks to evaluate an applicant, as illustrated by the following selection of quotes and interview notes:

- A captain would call other captains for hiring, more or less through the grapevine (captain, Seattle, No. 083).
- "I know all the skippers because the fleet has shrunk so I can ask them about someone who wants to be a deckhand and our jobs are coveted on this boat so I can be choosy. But they can be choosy about me too" (captain, Dutch Harbor, No. 004).
- "It's about reputation; you take both the good and bad into account" (former captain, Seattle, No. 082).
- "Finding a crab job is more like dating because it's more about who you know. If you cheat on your old lady, people will say things behind your back. And when you've got a girlfriend, everyone is interested" (former crew, Seattle, No. 076).

The hiring process for greenhorns, for emergency fill-ins after losing a person, and in times when it is too difficult to find experienced labor is different since there often may not be a candidate presented through social networks with a reputation that can be checked. In these cases, hiring seems more the chance of finding someone in the right place at the right time:

- Greenhorns are hired off the docks and from processors (former captain, Seattle, No. 083).
- If I need a half-share guy off the docks, "He's showing something just by being there" (captain, Seattle, No. 075).
- "Spots open up on the boats, because of injury, immigration enforcement and so on" (community member, Akutan, No. 056).
- "Sometimes we're just forced to take a body. If it's warm, it's hired" (captain, Seattle, No. 087).
- "If someone came down here [Fishermen's Terminal] now, they'd be working ten minutes later" (captain, Seattle, No. 075).
- "They'll take anyone holding their head up, and those guys often go for less" (former captain, Seattle, No. 083).

As one interviewee suggests, this urgent-hire process is not really different from before rationalization. When under the gun, a hire will be made regardless of the skill level. He says that "Even before rationalization in the derby, Olympic style fishery, they [skippers] were filling out crew with less experienced people" (processing plant employee, Dutch Harbor, No. 014).

Job Qualifications

While the processes of hiring may not have changed since rationalization, there is limited evidence to suggest that the qualifications of those hired may have changed. Specifically, there seems to be a more bimodal distribution of skill and experience among crew in the post-rationalization fisheries: one peak corresponding to people in their early crew careers and another for people late in their career, with a valley in between for mid-career cohorts. The pre-rationalization fisheries may have exhibited a more consistent or uniform distribution of experience with a long right-tail skew, as is seen in the analysis of Alaska commercial fishing vessel crew licenses in Carothers and Sepez (2005). That is, because of the steady background rate of turnover, one would expect a certain number of greenhorns every year with fewer returning each year-cohort over time, yielding the right-skew distribution. For positions requiring experience, the level of experience expected may have increased, likely due to the greater availability of such crew due to consolidation and job loss:

- "The more competition, the more picky the skippers can be" (community member, Dutch Harbor, No. 007).
- A captain hired experienced crew, about 20 years of total experience each means they are efficient and safe (captain, Akutan, No. 047).

- "It's more efficient if you have guys who know what they are doing, and you spend less on fuel because you can go faster" (boat owner, Seattle, No. 084).
- "I don't really like hiring guys without experience anymore, but sometimes you have to….At least [more experienced crew] know what they are getting into and it's still a dangerous job [so it is important to have experience]" (owner, Kodiak, No. 088).
- People who are in the fishery now are good. They are the ones who could get good jobs. There are also inexperienced crew members, but on the best boats, even the greenhorns have a lot of fishing experience, and some of it is with crab (crew, Seattle, No. 037).

However, some interviewees suggested that, rather than hiring more experienced crew members, under rationalization skippers have more time, so they can hire less experienced crew members because they do not have to respond to so much time pressure (community member, Dutch harbor, No. 007). A captain states that rationalization "has been about taking away the Olympic style derby and turning it into something more efficient. Efficient harvests allow more of a training period for the crew…It is a good thing" (captain, Dutch Harbor, No. 062). Also, it should be noted that while experience is a desirable job qualification, not so if it has been on too many different vessels. Captains can interpret that as being unable to keep a job:

- "We'd prefer a greenhorn. If we're picking between someone who's been on a lot, on 10 different boats, we'd pick the greenhorn" (boat owner, Seattle, No. 084).
- "You can not move around boats too much, you get a reputation very fast for not sticking with a job throughout the season" (former crew, Akutan, No. 046).

A concern about safety arises from the hiring process: "The industry has been getting steadily lobotomized, as less experienced crew members hire from their field of friends who have less experience than they do….and it would be very difficult to quantify how much the average experience level has gone down. But due to the fact that the overall goal was to reduce labor cost. It would be safe to say that industry felt that this was an acceptable price to pay" (former captain, Seattle, No. 083).

In the context of a large available pool of labor with a high level of experience, the persistence of the position of the greenhorn is somewhat problematic. Why hire someone new to fishing when there is, in theory, an ample supply of experienced crew? If many positions were lost, there would be a large pool of experienced labor without positions. The answer to this question is multifaceted and examined throughout this report, but revolves around several primary factors: the greenhorn can be expected to do the less desirable jobs that experienced crew will not do, the greenhorn can be trained to the vessel's or captain's particular way of doing things, and the greenhorn can be paid a lesser crew share, increasing the remaining available crew shares for experienced crew.

- "Sometimes there's an advantage to hiring inexperienced crew because they are more malleable and don't think they already know it all" (captain, Dutch Harbor, No. 058).

- "They can be trained the way we like on this boat" (captain, Dutch Harbor, No. 058).
- "Half the time it may not work out [with a greenhorn], but when it does it *really* works out. Eight times out of 10 it does not work out if it is someone who's been bouncing around a lot" (boat owner, Seattle, No. 084).
- A captain hired two greenhorns because the boat had lots of leased quota shares and a high number of full and large share guys and wanted to help them out (captain, Seattle, No. 065).
- "…So skippers can look for a greenhorn because they can play this game and there are guys fishing ½ shares for 4 years. It's cheaper to get a greenhorn than someone with experience and knowledge" (community member, Akutan, No. 050).
- "There are a lot more greenhorns fishing because older [more senior to the fishery] guys are not going to go out for $100/$150 a day for weeks" (community member, Dutch Harbor, No. 012).

The existence of a large experienced labor pool is contrary to sentiments expressed in interviews that many vessels have had a hard time finding crew in the several years since rationalization was implemented:

- "If you talk to skippers, they're not finding them [crew] but the press is full of stories of all those people losing their jobs" (processing plant employee, Dutch Harbor, No. 013).
- Alaska-based boats are having the hardest time crewing up. There is a really limited labor pool that they can draw from (boat owner, Seattle, No. 084).

Of the wide variety of explanations offered by our interview subjects for the difficulty some vessels experienced in finding crew, the most persistent was the change in conditions (elaborated upon in the Work Characteristics section) since rationalization. As expressed by an observer of the fishery, "It's getting harder [for boats] to keep good crew because of conditions [season length and compensation rates on some boats]" (processing plant employee, Dutch Harbor, No. 014). These conditions include most prominently the longer length of fishing seasons and the compensation rates, each of which will be discussed below.

C-Shares

At the inception of the rationalization program, captains/skippers were issued shares to 3% of the total harvester quota. These quota chares are known as C-shares and like B-shares (10% of the total harvester quota), but unlike A-shares (87% of the harvester quota), C-shares are not matched with processing quota held by processing plants so deliveries can be negotiated with any plant. C-shares held by captains may thus yield 3% of the available IFQ every year.

The discussion of shares allocated to crew featured prominently in several interviews, which reflects the importance of the issue. C-shares were intended to include crew in the initial distribution of fishing rights to increase opportunities for crew and to recognize their historical participation. However, the effect has been mixed (see also Lewis 2005). Comments reflected on the current value of C-shares to captains, as well as on the hopes of other crew members who do not currently hold shares. The lack of capital to buy shares and high levels of crew transience in the fishery suggested by ethnographic evidence suggest that C-shares may not be a sufficient mechanism to accomplish the goal of increased opportunity.[17] Many crew members pointed out that C-shares are currently available to purchase, but that they cannot afford to do so.

Many crew members expressed concern about the lack of shares allocated to them at the inception of the program. The concern is about issues of equity and fairness as much as it is about financial opportunity and financial security: "At the inception of rationalization, Council members put forward the 3% [shares for crew], which begs the question [for many crew members], why 3%? Why are only captains getting it?" (crew, Kodiak, No. 031). Another informant expresses a sense of deep disenfranchisement: "Owners got quota that is more than the boats [were worth]. What did crew get? They got handed a bleak future. They didn't have representation and that's the way things are going in this country. Labor is the last thing to get handed anything" (former captain, Seattle, No. 070). These perceptions of unfairness feed into a general sense of dissatisfaction and inequity and appear to be even more important than material considerations in some crew members' decisions about whether to continue to participate in the BSAI crab fisheries.

C-shares that were allocated to captains have also generated important positive changes for many. While some have left the fishery and subsequently sold their C-shares, others credit C-shares with their ability to continue to participate in the fishery:

- "Without C-shares, we'd all become bus drivers" (captain, Seattle, No. 082).
- "I like the IFQ part because it put a value on it. I started with those boats in 1979 or 1980 but none of that stuff (participation) had value. Boats themselves lost value (with rationalization) but access to the fishery, if you have IFQs, you're guaranteed a percentage. That's where the value is" (former captain, Kodiak, No. 081).

A former captain who is now in the longline industry elaborates on the importance of C-shares in his experience and the critical role he thinks they will play in the future of the BSAI crab industry as a whole:

> "When the allocations came out I received C shares along with a lot of other captains. With my new job on the longliner I have been able to moonlight into the crab fishery the last 7 years making a trip as captain or deckhand. I have also purchased C-shares…. This has allowed me to literally buy myself a position on deck or captain at my convenience. Also

[17] A NMFS crew loan program that is intended to facilitate crew purchases of C shares will be established.

> making money on my shares as well as my wages as deckhand or captain. My point on all of this is…that if a deckhand is to purchase shares (C-shares) this will strengthen his position as a key player in the industry and basically lay out the red carpet for him to climb the ladder in this industry. I would like to stress the importance of the C share program for the future of this industry. If you look at it years in the future this will be the way for a deckhand to build wealth towards one day becoming a captain or owning a vessel himself. There is a lot of greed making decisions for the deckhands at this time, from owners who don't want to give anything, to CDQ corporations, and also the processors who don't want their shares diminished. But if you look at this down the road when we are all dead and gone and the next new greenhorn is looking at starting in this business there has to be something for him to make him want to go into this, and the C shares make this possible" (former captain, Seattle, No. 071).

A former crab crew member and current participant in the halibut fishery corroborates that "quota is everything. [Boat owners] need guys with quota. Quota in the hands of crew is the next most empowering thing.…No one wants to go back to the derby days, no true fisherman does, but something is not right and something needs to be done. C-shares need to be made available" (former crew member, Seattle, No. 089).

Our research findings suggest that C-shares may play into hiring processes. C-shares can be used as assets that may influence hiring preferences. According to one captain, "Owners see me as an asset because I lease C-shares to them and then the boat gets to keep a percentage so it is a win-win situation. I hope it will push other crew and captains to do the same" (captain, Seattle, No. 071). However, from another point of view ownership of C-shares does not necessarily make a crew member who has purchased C-shares more valuable because it is not an important component in how crew are hired. A captain in Seattle relayed that C-shares are such a small addition to the larger quota pools, that even though C-shares could allow for some regional flexibility since they are not linked to delivery to a specific processor or region, they do not make a significant difference in these respects (captain, Seattle, No. 082).

C-shares are also considered to be important to the long-term sustainability of the BSAI crab fisheries which certainly rely on individual skill and experience. A boat owner considers that "We'd like to see some IFQ in the hands of crew….Owners understand that to make the program work we need to get quota in the hands of crew, as owners we see that. We are thinking about what we can do" (boat owner, Seattle, No. 084).

Finally, crew express that if C-shares are made more accessible to them, for example through a loan program, C-shares may offer a means for crew to invest financially as well as socially in longer term involvement:

- "You should have faith in the fishery you're involved in [by investing in C-shares]….You should make the decision to buy into fishing, have faith in it" (former captain, Kodiak, No. 081).

- "In the past owners always ended up selling part of the boat to the crew so they could work their way up from the deck through engineer position to captain. You were obligated to pay for the boat because you'd get loans and take a financial risk. Now you're better off trying to buy IFQ" (former crew, Kodiak, No. 081).
- A crew member considers that if he makes crab fishing his career, it would be silly not to invest in quota shares and attempt to buy them, but says he does not have the option of a good loan now and he is not sure about his commitment to crabbing as a career (crew, Seattle, No. 086).

It is important to recognize that the new goal of IFQ ownership has in some ways supplanted the former goal of boat ownership, and thus access to IFQ is another layer of both limitations and opportunities in a rationalized fishery. Indeed, the viability of purchasing C-shares, and the investments they allow, appear to be a critical issue: "Crew very rarely were able to make their way up from deck to being an owner of a boat. With rationalization it is now easier for crew to not only own IFQ (as the investment amount is much smaller) but it is also easier for crew to buy a boat as there are now boats for sale for reasonable prices. As a matter of fact there are a handful of skippers who have done just that, went out and bought a boat with little or no IFQ owned and made a go of it. This would have been very difficult prior to rationalization and much more risky" (boat owner, Seattle, No. 084).

Non-Crab Employment with Vessel

Crew contracts may stipulate participation in shipyard work or other fisheries such as salmon tendering during summer months or cod fishing. As one captain explains, the boats in his fleet are kept busy for 8 to 9 months of the year and crew are expected to be actively involved. The crew contracts for this captain's fleet "encompass the whole package….including crab and cod and builds in salmon and shipyard work. A common scenario is to have a new crew member do salmon tendering and if that works out then they come out for cod and crab." A typical crew contract with this captain's company has several basic components: vessel and crew names, terms and dates, crew shares, and a penalty if they leave early (i.e., if they quit they lose 1% share of what has already been fished). So if they were on a 5% share position they would get 4% of what has already been caught as of their departure date. These aspects of the contract serve as an incentive for people to not leave at the shipyard. The captain went on to say that while this is not always considered ideal, "people would like to do just king crab, hell, *I'd* like to do just king" (captain, Seattle, No. 082). At least one crewman reported his captain told him if he didn't fish "opies," he would not be allowed to fish the more lucrative red king crab season with the vessel.

Indeed, while such contract relationships, or perhaps less formal agreements along a similar principle, were present for several current crew members interviewed, it was not the case for a majority. One crew member who was working in the shipyard over the summer months explained that he is never obliged to tender or fish cod as part of a contract because he signs a separate contract for each season (crew, Seattle, No. 085).

A former crew member from Kodiak explained that in his view some of the ways in which losses to crew through rationalization have been calculated are flawed because tendering positions have been counted as jobs that make up for the diminished positions in crab. However, "saying there is no job loss because of tendering opportunities doesn't work, because we've *always* tendered" (former crew, Kodiak, No. 031).

A vessel owner in Seattle expressed that the role of non-crab employment in the shipyard must be considered when considering the effect of rationalization on crew. That is, in the pre-rationalization period many of his crew had to devote two or more weeks in the ship yard readying the vessel for a derby fishery lasting just a few days (yielding potentially misleading estimates of daily crew revenue when prep work is not considered).[18]

Crew Employment Decision Making

Analysis of interview data has allowed us to develop a conceptual model of a generalized crew perspective on seeking and finding employment in BSAI crab fisheries. Conceptual models such as the one presented here are known as ethnographic decision models or ethnographic decision trees. Like any model, decision models are empirically based representations of reality that can serve as an idealized 'map' – rather than claiming to *be* reality. They are particularly useful for the insight they provide into alternatives evaluated, points of contrast and comparison drawn, and contextual information about decisions. Essentially, decision models allow us insight into a set of factors that influence why individuals within groups make the decisions that they do (Gladwin 1989:8). Decision-modeling is done by aggregating information from several individuals. Decision models can therefore only be used as loosely predictive tools.

A central issue uncovered by this project is the process of crew employment decision making. Understanding how the decision is made to seek employment and when to accept an offer are particularly important given significantly fewer crew positions available and changed working conditions (especially lease fees and season length) following implementation of the rationalization program. The decisions made by crew about whether or not to pursue employment may shed light on the apparent paradox that, in fact, captains appear to be having a difficult time finding crew to fill positions, when there should, in theory, be a large available pool of labor.[19] This model represents aggregated information about the decision-making processes of several current and former BSAI crab crew members about whether or not to pursue employment in the rationalized crab fishery. It is important to recognize that this model does not capture the sense that some crew may feel that they do not have a choice not to fish, but that given their skills for crab fishing, they must go fishing if they have a position. As expressed by one Alaska-based crew member after calculating that he earns less crab fishing since

[18] It should be noted that no data are collected on such crew activities and it may be difficult to estimate the proportion of crew that work to ready vessels before fishing begins.

[19] We have not constructed a counterpart model of captains' decision-making about the hiring process, but such a model would provide important and complementary information.

2005, "I'm unable to quit even though it's going to tear my body apart until I become a cripple. I owe the government money, and I can't get out" (crew, Dutch Harbor, No. 063).[20]

As an example, consider the reasoning exhibited in the following crew member's narrative about fishing the 2007/2008 BSAI crab seasons, which helped in the construction of a crew decision model based on aggregated interview data:

> "I'd never actually do the 70/30[21] thing, I was hoping it would turn out differently but it sure didn't turn out worth a damn. We should have made $80, 000-100,000, We made $20,000. You're looking at $20,000 for a couple of months, what did we do before that? We didn't work, didn't work. If you have a family you have to go home and start working…Can I afford to quit my job on land when I have a wife and kids? Should I quit my land job now to go back to the ocean? No. So a lot of guys are staying home because they can't afford the downtime after our little $20,000….We [on this boat] fished all leased share… I'm still making, out of this 50/50[22] deal, I'm making pretty good off of it overall, I mean it's not what I expect I would have gotten in the old days….I had to actually go out and get a loan though after the [2007] king crab season to pay my year end bills! I went from a $36,000.00 pay check to a $20,000 pay check. Now people think that's a high pay check, but it really isn't. Not when it takes me $1,000 to get here and $1,000 to gear up. The longer I am away from home, it adds up. I have overhead when I leave the house. No one there's to fix my car, take care of the roof, shovel the driveway…. I have to pay for that so the longer I'm away from my home the more expenses I acquire. So it's not this big Discovery Channel paycheck for $20,000 in 3 days. We've seen that, but not anymore. We're fishing longer to make the same amount of money. We have to make the same money to pay the same bills. Now me, I downsized when this happened. I sold all my stuff when this happened, slowly liquidating assets. We're all in the process of downsizing" (crew, Akutan, No. 051).

[20] The reader should be aware, as we discuss at various points throughout this report, that prices dropped significantly in 2005 and fuel costs nearly doubled, both of which contributed to the losses in earnings many crewmembers discussed.
[21] Referring to the lease fees in the BSAI red king crab fishery that can amount to 70% of gross revenues.
[22] Referring to the lease fees in the BSAI opilio crab fishery that can amount to 50% of gross revenues

Discussion of these considerations by numerous interviewees were combined and analyzed to yield the following model.

Crab Crew Decision Model

Step 1: Will a person seek employment as BSAI crab crew?[23]

Question 1. Am I connected?
Do I have connections that make it possible to obtain a crab crew job, or am I willing to walk the docks in a crabbing location to get a job?

Answer 1a. If YES = Possibly Seek, go on to Question 2.
Answer 1b. If NO = Probably Not Seek, but go on to Question 6.

Question 2. Needs.
Do I need the income this year?

Primary evaluation criteria:
Economic status from other fisheries
Economic needs at home

Answer 2a. If YES = Possibly Seek, go on to Question 3.
Answer 2b. If NO = Probably Not Seek, but go on to Question 6.

Question 3. Compensation per unit of crew effort **(CPUCE)**
Is the income potential per unit of effort worthwhile?

Primary evaluation criteria:
Compared to other fisheries options
Compared to land-based options
Compared to the recent past

Answer 3a. If YES = Possibly Seek, go on to Question 4.
Answer 3b. If NO = Probably Not Seek, but go on to Question 6

Question 4. Time away at sea is time away from home
Is the time commitment away from land/homeport/family feasible?

Primary evaluation criteria:
Compared to other job possibilities
Considering current family needs at home
Compared to the recent past

Answer 4a. If YES = Probably Seek, go on to Question 5.
Answer 4b. If NO = Probably Not Seek, but go on to Question 6.

Question 5. Other work opportunities
Will the time commitment away preclude other necessary economic activities?

Primary evaluation criteria:
Other fisheries

[23] A consideration not listed here because it is not currently relevant under the stipulations for holders of C-shares is whether or not someone holds C-shares, and whether or not there are owner on board requirements.

Other land-based work

Answer 5a. If YES = Probably Not Seek, but go on to Question 6.
Answer 5b. If NO = Probably Seek, go on to Question 6.

Question 6: **Fishing for history**
Do I need to go fishing now to hold the spot for future purposes?

Primary evaluation criteria:

Likelihood of future job availability
Likelihood of future distribution of shares based on participation
Reputation and promised commitments

Answer 6a**.** If YES = Probably Seek, go on to Question 7.
Answer 6b: If NO = Probably Not Seek, but go on to Question 7.

Question 7: Job satisfaction
Is the satisfaction I will derive from the job worth the work investment?

Primary evaluation criteria:

Dissatisfaction due to diminished crew compensation on leased quota

Answer 7a. If YES = Probably Seek, go Step 2
Answer 7b. If NO = Probably Not Seek.

Note that not all questions in the decision tree are economic or financial alone. Family costs and opportunity costs factor in, and job satisfaction serves as a filter to the decision to seek employment, which may contradict the direction in which the socioeconomic questions are pushing the decision agent. Question 6 is something like a future opportunity cost consideration. Instead of asking, 'What are the costs of the opportunities I've missed by taking this opportunity?' (the classic opportunity cost consideration), it asks, rather, 'What are the costs of missing future opportunities that will not be available to me?'

Step 2: Seek employment in BSAI crab fisheries through social networks or through *in situ* dock inquiries.

Work Characteristics

Characteristics of work in the rationalized BSAI fisheries appear to have changed significantly under rationalization in terms of pay structure, season length, processor influence, safety at sea, and the compounding interactions between these factors. The impacts on work in the fisheries are extremely complex and effects of consolidation, quota leases, season length, crew experience, and safety are easily conflated. We make an attempt to describe these factors individually in the section, while also recognizing their interrelatedness.

Consolidation of the BSAI crab fleet was an intended goal of the rationalization program. By allocating resource privileges in the form of tradable quota shares, the number of vessels could be reduced and the quota shares of multiple quota holders could be

'stacked' on just one vessel. As noted previously, vessel numbers participating in the BSAI crab fisheries dropped from 256 in 2004 prior to rationalization to 86 in 2007. A processing plant manager emphasized that "we knew there would be consolidation under rationalization, but the amount was very surprising" (processing plant employee, Dutch Harbor, No. 014).

Owners of quota shares can lease quota to non-owners or to other owners. Information from interviews conducted in 2007 and 2008 suggests that lease rates averaged 70% of gross revenues for king crab and between 50 to 60% for opilio crab. Whether or not quota is leased, and at what rate, influences compensation received per unit crew effort (CPUCE). Whether or not additional quota is leased also influences the length of time a vessel will need to fish its quota, and thus the amount of time that crew members are active on the water. Evidence indicates that for crew on boats that lease the majority of their quota, the CPUCE is perceived to be less than before rationalization. Evidence from interviews suggests that these cumulative effects contribute significantly to a lowered level of morale among crew.

Changes in Pay Structure – the Effect of Royalties

While some boats continue to fish only their allocated quota, many boats have acquired additional quota through leases or purchases. The lease rates are quoted at approximately 70% for king crab and 50-60% for opilio crab.[24] Quota acquisition and consolidation is an expected and predicted outcome of rationalization that facilitates vessel consolidation and thus lowers the total fleet costs. However, the benefits of lower overall costs do not come free, as vessels acquiring quota from idle vessels pay royalties for the right to land their fish. These royalties are then frequently deducted from the gross revenue to yield a net that is split among active vessel owners, captains and crew -- as is often the case with other expenses like fuel, bait, or groceries. Notably, changes have occurred in those areas as well. In the first three years after the inception of the rationalization program, prices for fuel nearly doubled (see http://www.psmfc.org/efin/data/fuel.htmlNo. FUEL_AK for fuel price data). This cost increase is also shared by vessel owners and crew and thus further detracts from the bottom line of crew. That red king crab prices dropped over one dollar per pound during that time period did not help either. It is likely that the presence and timing of these market impacts have exacerbated the impacts of the additional costs of leased quota. Dalton (2008) shows that the price dip is not an impact of rationalization, but the timing makes it perceived as such by some (skipper, Seattle No. 058). This was perceived to be an effect more of processor quota than of rationalization itself, which enhances the level of control processors have over price setting. The rationalization program included an arbitration process to "minimize anti-trust risks" for crab harvesters and processors negotiating price contracts.

Interview results suggest that there is no consistent way in which lease costs are passed on to the crew. Thus, the additional costs of leasing or buying quota beyond the originally

[24] The actual rates at which quota is leased to specific boats can be analyzed to some extent with the EDR dataset, but data often reflect in-kind trades and thus may be subject to error.

allocated quota share decrease the profitability of that additional catch relative to the allocated quota for all parties in various ways depending on how the contracts are defined. In some cases crew are exempt from the fees, and most frequently these costs are shared. In *some* circumstances crew may also be charged for the quota the vessel owner received through the initial allocation (presumably to reflect the owner's opportunity cost of fishing that quota rather than leasing it to another vessel), which was particularly upsetting to interviewees. One former captain claimed that "most boat owners are charging something on their originally issued quota, the ones that don't hold themselves up as examples. If for no other reason than they don't want the gravy train to end or the program to be cast in a bad light" (former captain, Seattle, No. 083). Our interview data suggest that this deduction is not charged by "most" vessel owners and that the notion of such practice arising appeared to upset some owners who are against charging royalties on the quota they own that is fished on their vessels. A Seattle based owner observed that "In the Bering Sea there are a few who charge royalties on initially allocated quota, but the major players are not" (boat owner, Seattle, No. 084). In sum, the royalty fees charged to crew to share the costs of these quota acquisitions, which decrease the CPUCE, represented a particularly controversial and sensitive topic in our crew interviews.

In particular, crew members generally expressed that they do not want to work on a boat with high royalties because of their belief that owners are retaining disproportionate amounts of the earnings relative to effort. As expressed by one former captain: "You don't pay someone that doesn't work" (former captain, Seattle, No. 070a). This is corroborated by the captain of a boat with a large proportion of leased quota who observed "I don't have a lot of people calling" (boat owner, Kodiak, No. 088). A Seattle-based crewmember states "Experienced guys are getting out if they can. Or getting the good jobs on boats with owner quota" (crew, Dutch Harbor, No. 045).

In one view, then, "through economic efforts, crew members have been aced out of the pie" (community member, Dutch Harbor, No. 012). A former crew member calculates that "as a percentage of income made on the boat, you're making a miniscule percentage of what you could make before rationalization" (former crew, Dutch Harbor, No. 019). This view was widespread among those interviewed:

- "The fishing industry is dying because it is too top heavy… Money is sucked out of the industry off the top with little being put back into it. People say you are doing OK because you are making money, but they are taking half so I feel I can say there is a huge disparity between owners and people [on the boats]" (crew, Seattle, No. 066).
- "I kind of expected it because it makes sense [economically]. Boat owners are OK, but crew are the ones who lose their livelihood…. I got an offer [of a job], but the money was so down. Plus I had friends who said it is not even worth it because the percentage is so down. The boat owners are all getting the big bucks" (former crew, Akutan, No. 046).
- "I know captains who can't find decent crew…Owners will lease quota to another vessel or to themselves and the crew gets paid on the remaining percentage after

the lease fee, so crew are fishing for very reduced shares than [the crew] on vessels fishing their own quota. I think it's why crew are not fishing…For the most part [rationalization] is a good thing. 95% of the boats are not leasing to themselves" (former captain, Seattle, No. 068).

- Seattle-based crew: "There is no consistency [in the amounts and treatment of quota, whether leased or owned] from boat to boat….The worst [scenario] is a boat with little poundage but high lease, even a little poundage with no lease is better" (crew, Seattle, No. 066).

Where the problem seems to arise among vessel owners and crew on this topic is that while on the margin it may be financially viable for a vessel to lease or purchase additional quota, crew may not find the effective wage paid on those additional crab to be worth their time because the CPUCE is much lower than on owned quota. For example, laborers may view this additional work as "overtime", which in many fields earns an overtime premium. Here, it is the opposite. Crew are effectively paid less per hour or per pound for this additional work. In many cases crew would rather not take on the additional quota but have no voice in the matter, and to earn the higher return on the allocated quota they must earn less per unit on the newly acquired quota. Moreover, and in parallel to the direct consequences to economic remuneration, interviews with experienced crew evidenced a sense of disenfranchisement. This is attributed to observations that while the economic wealth generated by the implementation of quotas has accrued also exclusively to quota owners, income and bargaining power of crew has diminished relative to quota owners. C-share ownership by crew has not been widespread enough to mitigate this feeling.

Alternatively, the business owner looks at the profit margin from bringing in additional crab, and as long as it is still positive, it is still worthwhile – especially since he has a large outlay of fixed costs that he must cover using the profits he earns at sea. Crew also recognize the business strategies at work here, noting that some boats will take higher lease fees "because a lot of these guys have boat payments. So, it's 'do I lose my boat or do I fish for less?'" (crew, Akutan, No. 051).

As other interviewees describe it, the problem may not derive from the royalties on leased quota per se, but the current lease rates for quota, which are set by the market, which comprises owners who evaluate purchases on the marginal profit, not the CPUCE. As mentioned above, during our interviews, rates as high as 70% were common in king crab and were reported by interviewees to approach 50%-60% for opilio crab. Thus, "if a pie of owner quota is [for example] 100,000,000 pounds then the crew shares are around 40% of the net revenue extracted from that, while a pie of leased quota that is also 100,000,000 pounds becomes equivalent to 30,000,000 pounds after royalties are paid, leaving the slice of pie for crew shares still at around 40%, but from a smaller pie" (captain, Seattle, No. 065). A crew member echoed these sentiments, saying "I'd be happy with 60/40 [shares split in the king crab fishery]. At that, we could make a living" (crew, Dutch Harbor, No. 051).

Some current captains and crew expressed satisfaction with the amount of quota their vessels fish, both originally allocated (owned) and leased. One captain says openly that "I'm feeling lucky to be on a boat that does not fish leased quota" (captain, Akutan, No. 047). A captain on a vessel with approximately 700,000-800,000 pounds of crab, of which 500 is not leased, says that "you earn less on 'royalty crab' but we cost average all the crab so you don't think some crab is earning you less" (captain, Seattle, No. 082). Another captain says that his boat has 1.8 million pounds of owned quota and 120,000 pounds of leased quota. He estimates that he earns $120,000-140,000 a year which is four or five times more than before rationalization. He summarizes that "for us it's way better" (captain, Seattle, No. 075). Crew members may have a positive perspective on the increased total earnings, especially given that they have already invested in arriving at the fishing grounds and the added income is beneficial: "Before you had to be really lucky to catch 10,000 pounds of king crab, now you can catch more so people are making more" (crew, Seattle, No. 085). A crew member who has a position on a boat with 256,000 pounds of owned quota and a further 1,000,000 pounds of leased quota feels that this is a good proportion, but says he would not fish if the amount of leased quota was increased (crew, Seattle, No. 073).

In fact, many crew expressed that they would not continue to fish if the amount of leased quota on their boat increased. In one case, interviews with five crew members on a vessel in Dutch Harbor were conducted minutes after the crew were told that they would be fishing a larger proportion of leased quota than they had been lead to believe. This news arrived just hours before departing for the start of the BSAI opilio crab season. One crew member made the decision to leave the boat as a result (crew, Dutch Harbor, No. 044) because the new conditions essentially changed how he would answer Question 7, job satisfaction, on the decision tree. In another interview with several crew members on a boat that was fishing all leased shares in opilio crab, one crew member said "We don't get paid enough…It's getting to the point where I'm thinking about jumping out completely." Another crew member says that will probably be it for him as well. A third says "I build docks around Seattle now and that's where I'm at. I'm making just enough money down there to say it's not worth it to come up here anymore [reflecting Question 2, the "needs" question, on the decision tree]. Then what you'll end up with is a bunch of greenhorns on the boat. Guys are going to start getting hurt. Boat owners can't afford to fix the boat. They don't have money to work on them, he's [the boat owner] trying" (crew, Akutan, No. 051). Several themes here are discussed further is sections on greenhorns, participation in other industries and local opportunities, and safety.

Lease rates aside, some effects of the quota-based system were widely reported to be positive, particularly the reduction in uncertainty over the income that would be earned during a season. One former captain and current longline participant emphasized that in contrast to the derby days when "we would go out and work for 5 to 7 days straight [with] no guarantee of what you would make or if you owed the boat money if no crab was caught, at least now you know what you are going out to catch. Most vessels I know of pay the crew on original shares and then pay accordingly with the lease shares they fish. This in my opinion is working out for most guys and it will work itself out in time just like the halibut and blackcod fishery did" (former captain, Seattle, No. 071). Many

crew members expressed similar feelings regarding the new management strategy of the fishery.

In relation to the above section on crew experience and emerging trends, the changes to crew shares may be a disincentive for more experienced crew to continue in the fishery. One former crewmember from Oregon calculated that "When I looked at the numbers, I was not interested. There are tons and tons of good guys not doing it anymore because they are not interested in that type of compensation so there are less experienced people coming in. It's still kind of attractive for someone who doesn't have anything else" (former crew, Oregon, No. 080). Another former crewmember from Kodiak corroborates that "Most of the real crab fishermen are gone because they won't work in these conditions. Those who are crabbing now are those who don't know any better" (former crew, Kodiak, No. 031). This pertains to Question 3 of the decision tree, CPUCE: they have no recent past to compare to the present.

The reluctance and even unwillingness of crew to fish leased quota on a diminished rate of compensation may in part explain the fewer than expected numbers of people looking for crew jobs in spite of the marked contraction in vessel numbers (and jobs) in the BSAI crab fisheries following rationalization:

- "I know captains who can't find decent crew…Owners will lease quota to another vessel and the crew gets paid on the remaining percentage after the lease fee, so crew are fishing for very reduced shares than [the crew] on vessels fishing their own quota. I think it's why crew are not fishing" (former captain, Seattle, No. 068).
- "I was hiring guys I'd hired before and then fired, just to get [the job] done" (boat owner, Kodiak, No. 088).

There are follow through impacts to the hiring processes. As expressed by one crew, "the jobs that are left are competed for and it's swung the balance of power in favor of the employer. It has meant that they can hire people for less percentage because there are not many other options and you gotta work for a lesser job"(crew, Dutch Harbor, No. 063). A subsequent effect might be that "the captain makes money, but he also drops wages [because he can due to increased competition for those remaining 300 positions]. That's a secondary disaster" (community member, Dutch Harbor, No. 012). So, "to keep quality people you have to have a good crew share" (processing plant employee, Dutch Harbor, No. 015). There is thus a fear that "in the future, [control] will move further away from crew and consolidate the power in the hands of owners who will pay what they want to so that they will only get people that will work for that… who will not be experienced. Good guys aren't gonna stay" (former captain, Seattle, No. 070). In light of this, a Seattle-based captain says that he actually takes a reduced share in order to pay crew more because he wants to retain the good crew members who have worked with him for years (captain, Seattle, No. 065).

This apparent paradox, that crew are hard to find and hire but that there is increased competition for available jobs is likely explained by the fact that not all crew have equal

skills and levels of experience. Note that several of the interviewees emphasize that it is *good* crew that are hard to find.

In this section, we have attempted to convey the information we received on an aspect of the post-rationalization fisheries that generated the most commonly expressed feelings of disaffection and inequity. However, comments by many crew members indicate that they are in fact doing well financially and their sense of job satisfaction is high. As a general rule, those who expressed positive attitudes toward their experience in the rationalized BSAI crab fisheries held positions on vessels with relatively low amounts of leased quota. This observation is especially significant for two reasons. Firstly, it underscores the heterogeneity of experiences in the fishery and the impossibility of characterizing a singular trend regarding how crew members are affected by a quota-based management system. Secondly, it highlights the importance of collecting accurate information through the EDRs on the type and magnitude of costs (e.g., lease costs) that are deducted from crew settlements to assess the way in which crew compensation structure may evolve over time.

Season Length

Two primary factors associated with the rationalization of the BSAI crab fisheries have increased the length of fishing seasons. Firstly, with rationalization came the end of the race for fish, and secondly, fewer vessels have more fish to catch, keeping them on the fishing grounds for longer periods of time. Other factors were also identified as contributing, sometimes less directly, to longer seasons, including longer soak times, the ability to wait out inclement weather or periods when the northern grounds become ice-covered, as well as delivery dates set by processing plants that may dictate fishing schedules.

The "seasons are the same length if you only fish the quota that [the vessel owner] owns, but they are longer if you lease quota" (former captain, Seattle, No. 068). The increased season length may be problematic for crew who participate in other fisheries, but is also seen to "professionalize" the crab positions. Depending upon how the longer seasons are managed, it may extend the time away from family and home or it may offer the chance to rotate crew and provide breaks to those who are involved in BSAI fisheries for up to nine months a year.

Under rationalization, the king crab fishery has been significantly extended. One captain remembers that "Before rationalization, people arrived in Dutch Harbor in early October for shipyard work. Fish for 3 days starting October 25th, tie up for 7-8 days before offloading the crab, and the boats were tied up by the beginning of November" (captain, Seattle, No. 065). A crew member explains: "Now the seasons are a little longer, before we would be out for about 2 weeks, now it's 2 months [for king]" (crew, Seattle, No. 085).

These longer seasons contrast sharply with the short seasons that existed since the late 1990s, due to stock declines and additional vessel entry to the crab fisheries.[25] Previously, even with the race for fish, seasons were longer and may more closely resemble the current length of BSAI crab fishing seasons. For example, the Bristol Bay red king crab fishery alone extended for 40 days in 1980. [26] "It's only since 2000 [when seasons became that short] because resources tanked… Before that they were 4-6 months…. Some of those guys remember the 1980s when seasons were longer so they are happy with the way it is now" (boat owner, Seattle, No. 084).

While the post-rationalization season lengths have increased and boats are spending longer on the fishing grounds, there is a diversity of opinions about how this relates to rates of compensation. Complicating matters are the impacts on crew income associated with increased fuel prices and lower ex-vessel prices, which may be confounded by structural changes due to crab rationalization in respondents' perceptions. Many expressed that they are working longer for the same or reduced compensation while others explain that the longer seasons does translate into greater pay overall.

- "Now, the season is too long for too bad pay" (former crew, Kodiak, No. 027).
- "Rationalization is good and bad. The money is guaranteed, which is good, but you get the same amount for a lot longer season" (crew, Dutch Harbor, No. 005).
- "Now, we keep the boat busy eight to nine months of the year. So guys are working now much more, they are away from home more, and they are compensated more" (captain, Seattle, No. 082).
- "We work two times harder, twice as long for a third of the money" (crew, Kodiak, No. 032).
- "With leases we're not making as much and we're gone for longer" (crew, Seattle, No. 066).
- "Other boats I could get on have too much quota [and you have to fish for longer to earn money] so I'm not interested in participating in the longer seasons. It would have to be a really attractive deal for me to consider going back to crab and it'd be a fill-in job for part of a season. I'd just go for a short duration not get tangled up in a long-term thing. If you get tied up in the shipyard and everything its over 7 months" (former captain, Oregon, No. 080).

There are, however, also positive outcomes of longer fishing seasons for some people. When it does not cause a scheduling conflict, increased season length is viewed as a chance to increase the amount of money made overall, even if the compensation per unit of effort is diminished from the average pre-rationalization experience as noted above (and discussed in the following section). Additionally, longer seasons may be seen to justify the time spent in the shipyard preparing for fishing, which is relatively the same regardless of a 3 day, 3 week, or 3 month fishing season: "Under rationalization we are

[25] Some of the entry occurred due to "rent seeking" behavior by vessel owners seeking to establish a catch history (and thus quota allocation) as the fishery moved from regulated open access, to a license limitation program, and then to the subsequent rationalized fishery. This is similar to Question 6, the fishing for history question, of the decision tree.
[26] See the 2007 BSAI crab SAFE Report for detailed historic season lengths.

working more but have the same amount of start up work as [we did] in the past but you're not paid anything for gearing up in Dutch harbor – 10 days getting ready for 3 months vs. 3 weeks" (crew, Seattle, No. 085). Unfortunately, little data on dock preparation time required has been collected; more would be needed for an accurate CPUCE calculation (c.f. Abbott et al. 2010).

- "Crew would rather stay out and fish royalty quota after they have fished allocated quota which they would have been fishing anyway [under rationalization]" (boat owner, Seattle, No. 084).
- "With rationalization we spend more time [crab fishing] and there is everything associated with that, including more money" (crew, Seattle, No. 085).

A further benefit is the ability of some boats to rotate crew and captains by hiring relief crew:

- "The boats that are doing the best try to get a revolving crew to give some people a break" (crew, Seattle, No. 066).
- "If there are long seasons, you also have time to rotate out so you can see your family" (crew, Seattle, No. 086).

For some, longer seasons together with increased job security and guaranteed compensation contribute to the professionalization of the BSAI crab fisheries:

- "A lot of people are here as professionals, we call it 'our job' (crew, Seattle, No. 086).
- "The guys that do have jobs have good jobs. They can make a living and raise a family. They don't have to get two-bit construction jobs when they're not fishing up here. More income means they can count in it all year" (captain, Dutch Harbor, No. 004).
- "Now they're fishing for a whole season – it's become a professional crew position. That stable type of position wasn't available before. It provides some level of security. You know the boat has quota" (processing plant employee, Kodiak, No. 034).
- "We're either crab fishermen or not….Now guys have a full time job. Before, you'd throw your dice. We were gamblers. Now you're a crabber" (captain, Dutch Harbor, No. 058).

Extended fishing seasons introduce temporal conflicts for crew members who do participate in multiple fisheries. Multi-fishery participation is often an important livelihood strategy based on diversification which may reflect individuals' abilities to adapt to often volatile and unpredictable fishing. Further, participation in multiple fisheries is lifestyle that carries a deep cultural heritage, and is a typical strategy found among fishing communities found all over the world.

- "The long seasons are really different. Three to four months, it takes a different mentality" (Seattle based skipper No. 087).

- "In this day and age you have to go from one fishery to the next to make your yearly income and we can lose that opportunity to make the income you need when you miss the open day" (crew, Akutan, No. 051).
- "People give up on crab because they spend more time on halibut and salmon. "I have two crew who can't commit because they are working in halibut in March. The halibut season has been extended and there is more money" (captain, Seattle, No. 065).
- "There are short pulse fisheries. I won't hire someone who wants to go halibut and pollock fishing. He's not a professional crab crew and I won't hire him. Now you can be a crab professional and make good money for 6 months of fishing…. But we pay better than anyone because we have so much quota" (boat owner, Seattle, No. 084).

Crew and potential crew members' abilities to commit to longer fishing seasons is also a factor in hiring processes and may contribute to the apparent lack of employable crew observed by some captains.

- "Captains are not finding crew. People are making good money, but they are gonna be up there for a long time – all seasons, 6 months to a year. So a guy could make more than he used to, but there's no way he could keep a second job" (former crew, Seattle, No. 070).
- "I've testified to the Council about crew positions. I always have conversations with other captains, like on the [Seattle-based] boats, that we can't find crew. It's just the guys looking for the 2-week wonder jobs that can't find work now. But it's people who need to commit to 8 to 9 months that we need and can't find" (captain, Seattle, No. 082).

Compensation Per Unit of Crew Effort (CPUCE)

A major effect of rationalization reported in our interviews pertained to the rate of crew earnings relative to work, or compensation per unit of crew effort (CPUCE). This is a measure similar to catch per unit effort (CPUE), which is usually based on vessel effort as the unit of analysis. Decreased CPUCE can result when one is aboard a vessel that fishes a longer season due to the acquisition of leased quota, which carries with it a diminished rate of per unit crew compensation (and profitability) due to its lease cost. As detailed above, royalties are paid on quota that is leased and "when you have lease shares, a lot of the costs flow through to the crew" (former crew, Dutch Harbor, No. 019). Crew may therefore receive a lower rate of compensation per day or per crab than they had prior to rationalization (notwithstanding changes in fuel and ex-vessel prices noted above). The effects on CPUCE are largely driven by changes to the cost structures detailed above. The combination of extended fishing seasons and reduced CPUCE mean that, in the words of one captain, "it has been a hard adjustment to go from derby to rationalization. Some can't adjust, including financially" (captain, Dutch Harbor, No. 004). According to one crew member's experience, prior to rationalization crew shares comprised 5-7% of net earnings. Fuel, bait, groceries, and associated taxes including

delivery fees, were taken out of the total, and then crew shares are paid off of the remainder. Now, the lease is paid off the top then shares and expenses come out of the new remainder (crew, Seattle, No. 066).The leased shares generate a higher gross revenue, but crew earnings on a per unit basis is not as high. Thus, the job security of a longer season based on guaranteed quota does not necessarily make a position on a crab boat more desirable. As this crew member elaborates, "it doesn't matter if you know you are going to make $20,000 when you work 3 times as long and 3 times harder for the same thing" (crew, Seattle, No. 066). Another crew member who has not fished since the first year of rationalization (2005) calculates that for the same amount of crab fished, he would have earned significantly more than $100,000 in 1999 and only $29,000 in 2005 (former crew, Oregon, No. 080). Another crew calculates that he "went from $45,000 - 50,000 fishing year round down to $25,000 - 30,000 for both king crab and opilio crab" (crew, Akutan, No. 051). [27]

- "I see it that the only people who really come out ahead on this are the owners that own the quota. So now you get the fleet, the workers, making less money, but they are working longer too so there might be some boats that keep them on the full share thing and they're making good money and some boats say no…it's a monthly salary and that's it" (Plant manager, Dutch Harbor, No. 002).
- "If we continue down this path, there will be even fewer jobs, they'll be drafting wagers on the decks" (former crew, Dutch Harbor, No. 006).
- Guys who will do it for $100 a day "It's an indentured servant thing" (former crew, Kodiak, No. 023).
- "It used to be about how much you could catch, now it's about how cheap you can catch it…and that goes for the people too" (former crew, Seattle, No. 070a).
- "Serious guys ended up staying because no one's gonna put up with a so-so deckhand in this diminished employee pool…they're gonna pick the best they can and they're gonna dictate to us what they're gonna pay us….they are giving us one price up front and now we're looking at getting [it] knocked down" (crew, Akutan, No. 051).
- "At some point we will reach the bottom line scenario – that people will not work for diminished pay due to lease fees – but by then, everyone will probably be working for wages anyway" (former captain, Seattle, No. 070).

It is important to recognize that the livelihoods derived from fisheries are always dynamic and responsive to multiple factors. One former captain who has been involved in BSAI crab fisheries from 1979 to 2007 emphasized the economic outcomes of the trends he experienced during his fishing career: "The TACs (total allowable catch) were higher [on opilio crab] from the mid 1980s to the mid 1990s and we might be fishing from early January to late June, and making $8,000 -10,000 per month. That was good. But then it changed and from the late 1990s until rationalization you could not make a livelihood just fishing" (former captain, Seattle, No. 090).

[27] Another recurrent concern expressed in interviews was a shift toward a wage-based workforce with increasing numbers of undocumented participants who may not have legal standing in the United States and therefore less recourse to enforce their rights, although it should be noted that we found no empirical evidence to support these assertions.

Finally, it should again be emphasized that increased fuel costs and lower prices for crab as a result of the world market for crab also contribute to lower crew revenues derived from crab harvests. These global market fluxes have been found to be unrelated to rationalization (Dalton 2008), but we are aware that from the point of view of crew who are receiving less compensation per crab, these two contributing factors may become conflated. A drop in prices for crab products in the first years of the rationalized fishery was in large part due to high numbers of Russian crab flooding world markets increasing supplies and reducing prices. According to the stock assessment and fishery evaluation (SAFE) report for the king and Tanner crab fisheries of the Bering Sea and Aleutian Islands regions 2007, ex-vessel prices for red king crab fell from $4.71/lb in 2004 to $4.24/lb in 2005 and $3.48/lb in 2006.[28]

Processor Delivery Schedules

Most companies which hold processing quota for A share BSAI crab have responded to the longer fishing seasons and associated concerns over (costly) idle plant days by implementing scheduled deliveries to specific plants. Deliveries are further regionalized by community protection measures. The coordination of deliveries is negotiated prior to the opening of the fishing season by boat cooperatives and may reflect historical relationships between boat and processor companies. As of the 2007/2008 fishing seasons at least one major processing plant has refrained from setting strict delivery schedules in recognition of the hardships this may impose on fishing. Keeping a processing crew on hand and the processing lines open incurs costs that could be reduced by scheduling deliveries, but the processing company sees it as a way to attract B and C share crab that are not designated to specific plants as well as reflecting a longstanding relationship with a loyal fleet (plant manager, Dutch Harbor, No. 014).

A significant economic incentive to comply with agreed-to delivery dates comes from the perception that the price will be lowered by processing companies if deliveries are received behind schedule. On this topic, one crew asserts “Tell me that doesn’t impact us as much as competing [in derby fishery].” A captain shares the view that “rationalization may have done away with the race for fish derby, but the 90/10 split has created a ‘processor derby’ in its wake” (captain, Dutch harbor, No. 020). In place of the race for fish, in some cases there may be a race for processors.

Initial difficulties in the first years of rationalization caused by the scheduling of delivery dates may be getting ‘ironed’ out:

- “The canneries improved in a year. Last year we had 30 days between deliveries of opie’s, but this year they’re working tight” (captain, Dutch Harbor, No. 058).

[28] See table 2-2 on page 6-31 of the 2007 Stock Assessment and Fishery Evaluation Report for the king and Tanner crab fisheries of the Bering Sea and Aleutian Islands Regions, NPFMC, 605 W. 4th., Anchorage AK 99510.

- "[Delivery and offload coordination] is getting better. I thought it was a total joke the first year. But it's getting better. If you have to wait in line for 4 days to offload, the opportunity cost of fish not caught is greater than the price of fuel and expenses to get to another processor, get offloaded sooner, and get back out to fish" (captain, Seattle, No. 087).

The benefits of scheduled deliveries, especially when well coordinated with a vessel's fishing grounds (usually through planning within the coop), are that fishing, deliveries, and the vagaries of weather (or other unpredictable influences) can be synchronized. One captain happily explains that "It's the most beautiful thing. I know when my dates are: I could fill the boat in 3 days if I wanted to, but I have 6 days between deliveries so I can also be more cautious…So, if I'm stressing I don't have to haul gear. If it starts blowing, I say 'guys, we're done' " (captain, Dutch harbor, No. 058).

However, an apparently more common response to processor delivery schedules that stipulate the date and location of offloads are of dissatisfaction, ranging from mild to critical concern about risk from unsafe conditions that perpetuate under the 'race for processors':

- "The worst thing is the 90/10 split. It was sold on safety. It is not about safety. I fish in really inclement weather because they drop the price if you miss the deadline [for offloading at the processor" (crew, Seattle, No. 073 crew).
- "A few years ago we delivered to St Paul, so now we're committed to them. But often it's bad weather. That happened once, we couldn't get in [to make the offload] and the processor charged us for each day [that the delivery was delayed]" (crew, Dutch Harbor, No. 008).
- "It's really a time deal. We're only sleeping 2-4 hours a night to meet delivery schedules, especially if we haven't been on the crab" (crew, Seattle, No. 073).
- "You're still not able to sit out high winds because they're under the gun – the processors dictate the schedule" (former crew, Kodiak, No. 023).
- "The industry hasn't done anything but worsen: It is not safer…[processor] companies dictate delivery times. You better have your crab or they'll put you off" (former crew, Dutch Harbor, No. 006).
- It's not safer because we still have to fish weather to make processor dates. If we miss it, we have to wait a week and time is money so it is expensive (captain, Akutan, No. 047).
- "It was a lie to predict that safety would increase, a total lie because with the 90/10 split allocation the processors control explicitly everything they need so they have a …time schedule so they dictate delivery dates. It's still an incredible race for fish and safety is not improved" (former crew, Oregon, No. 080).

In summary, the information elicited in our interviews suggest that pre-arranged processor delivery schedules have a range of benefits and potential costs that must be considered by skippers. Benefits can be obtained by avoiding the need to wait in a queue to deliver at flexible delivery processors (e.g., decreased crab deadloss, smaller opportunity costs of time and profits that could be earned in other fisheries, fewer

groceries consumed by idle crew). These benefits must be weighed against the costs of delivering instead to another processor with a fixed delivery schedule (e.g., decreased trip flexibility, potential price cuts for not meeting the delivery date, safety considerations associated with avoiding such price cuts, and potentially higher fuel costs if the scheduled processor is geographically more distant than the flexible delivery plants).

Safety

Safety concerns have often been mentioned in the discussion of rationalization, and were raised by crew members in nearly every interview with crew for this project. At the time of this study, after nearly 3 years of implementation of the rationalization program, no fatalities have occurred in BSAI crab fisheries. Still, opinions diverged in our interviews about the success of the program to meet its safety-related goals. Indeed, the extreme conditions of the Bering Sea mean that safety risks can never approach zero.[29] Many see safety as having declined because of the trend to lower costs across the board so that the remaining boats "are the ones that were able to operate the most efficiently and the cheapest" (former captain, Seattle, No. 083). Others believe that boat maintenance has in fact increased, and that whereas in the past vessel owners had to make difficult decisions to address only the most urgent maintenance issues, now the boats receive total overhauls at more frequent intervals (former captain, Seattle, No. 090)."

Some see the inflexible processor schedules as the ultimate cause of hazardous conditions that remain independent of safety measures: "It's not safer on the water. You're still under pressure, and it's still the same problem: if you go over, you'll probably die" (crew, Seattle, No. 037). As mentioned in the section above, the imposition of delivery dates and penalties if they are missed are seen by some to replace the "race for fish" with an equally unsafe "race to the processors".

Others agree that changes have been minimal, and if safety has increased it is attributable to efforts of the U.S. Coast Guard rather than outcomes of the rationalization program:

- "It hasn't changed an iota. When it is blowing SW 70, I don't care what quota we have" (crew, Dutch Harbor, No. 063)
- "It's a little safer. We're still doing the same thing 90% of the time in the same weather. There are some cases when we're working like idiots in idiot weather. Especially if have a lot of pounds" (crew, Seattle, No. 086).
- "The Coast Guard would say this is because of the enforced dock side inspections preseason" (Captain, Seattle, No. 082)
- It was not completely unsafe before rationalization. If the weather was predicted to be really bad, the Coast Guard wouldn't let us go out (captain, Dutch Harbor, No. 015).

[29] Statistics from the U.S.Coast Guard pertaining to incidents on the Bering Sea reported on BSAI crab vessels needs to be analyzed in this regard.

Safety fears pervade, in spite of the intention of the program to improve safety for boat captains and crew:

- People still have to go out in bad weather because of fuel costs and other overhead (Plant manager, Dutch Harbor, No. 002).
- "The whole safety thing, that's half of it turns out not to be true!" (former crew, Dutch Harbor, No. 012).
- "Safety was a smoke and mirrors thing. Nothing has changed" (captain, Seattle, No. 067).

Fewer boats on the water due to the federal buyback and implementation of the program also means that boats in distress are more isolated and potential help is further away. Moreover, the longer seasons are seen to increase exposure to risk. "It took one month, now it takes 2- 5 months and you take more risk because it takes more of your time [and the longer you are out here the more exposure you have]" (former crew, Seattle, No. 066).

Time is money on the water, and costs combine with fishing conditions to motivate expedited fishing:

- "There are other reasons for fishing as quickly as possible, and other constraints that mean that just stopping the derby style is not enough to change how safe it is out on the water when we're fishing for crab. Processors push us through, and captains just want to get home" (crew, Dutch Harbor, No. 008).
- "I don't want to spend extra money on food and fuel so I need to make sure we get to the processors [without delay]" (captain, Kodiak, No. 047).
- Some people say you don't have to go out when it's shitty, but we went out anyway because the captain makes the call – "he says work, we work" (former crew, Akutan, No. 048).

Levels of crew experience have implications for safety in that less experienced crew may not be versed in maintaining safe practices at sea and may not have the knowledge about boats to identify problems. A high crew turnover rate may also contribute to lower concern about maintenance and upkeep of the vessel:

- Worried about ever being in a situation with inexperienced crew who are dangerous (crew, Akutan, No. 047).
- "If you want safety, you have to have guys who will stick around longer" (boat owner, Seattle, No. 084).
- "Safety is one of the biggest issues. Now, people on boats are not fishermen, but others, who will work for less. They don't know the boats, and don't know if something is wrong" (former crew, Kodiak, No. 027).

Importantly, others perceive an increase in safety under rationalization underscoring that fishing is a diverse practice and individual boats are managed differently. Further inquiry into safety issues could help to identify the variables that contribute to the variation in

views on safety, but was beyond the immediate scope of the present study. Increases in safety are due to a slower pace of fishing and the ability to wait out inclement weather:

- "Oh, it's night and day. Now, we can just stop because some bad weather came up so the risk factor is diminished. How do you put a dollar sign on someone's life? Nothing else you say holds water….1,000 jobs does not equal one person's life" (captain, Dutch Harbor, No. 004).
- "One thing, it's made it safer. [Avoiding bad weather means] less stress in equipment [and] less stress on crew" (community member, Dutch Harbor, No. 007).
- "[There are benefits from] slowing fishing down, with fewer injuries now and I don't know if there has been any loss of life since rationalization" (captain, Seattle, No. 082).
- "If a big storm blows in, we don't have to go out" (crew, Oregon, No. 077).
- "The 80 boats remaining [in the fishery] are the 80 best boats" (captain, Seattle, No. 065).
- "You get a whole night's sleep as opposed to 3 hours in open access fishing" (captain, Dutch Harbor, No. 058).

Given the vital importance of safety to BSAI crab fishery managers and participants, we are concerned about the somewhat contradictory views on the issue uncovered in interviews with both captains and crew members. While both the fatality data and many people interviewed do attest that safety has increased with the end of the race for fish, and can provide concrete reasons for increased safety such as a slower pace of fishing or being able to wait out storms, the view was not ubiquitous. That some people claim to feel no improvement in the level of safety is a somewhat surprising finding. The individuals in our study who felt this way most commonly attributed it to a continued frenetic work pace on vessels (which is endemic to the crab fishing culture) or a desire to meet delivery schedules. Based on the range of perceptions of safety, our interview data suggest that rationalization was a necessary, but not in itself sufficient, means to improve safety at sea for all vessels. Ultimately the captain's philosophy and business strategies dictate the working conditions impacting safety aboard a vessel.

Alternative Employment Opportunities

Alternative and additional employment opportunities may affect crew members' abilities and decisions to participate in the BSAI crab fisheries. Multi-fishery and even multi-industry approaches are harder with longer crab fishing seasons and other obligations to the boat that now extend across several months. As related above in the section on work conditions, longer seasons may prevent participation in multiple different fisheries or industries by increasing the annual time commitment related to crab fishing. For many, longer seasons in crab may represent job security, but problems arise for others who depend on income from crab fishing to support other endeavors such as other fishing operations or small businesses. As expressed by a Seattle based skipper, "I think this is becoming a full-time job and a lot of displaced workers were happy as part time because they did so many other fisheries, pot cod, etc. That's the type of fishermen they are –

that's why they are out of work [in the crab fishery]. [Crab] is all our boats do. We're dedicated to our boats.' (captain, Seattle, No. 087).

Participation in other fisheries -- Multi-fishery strategies including participation in multiple BSAI crab fisheries are common amongst crew members interviewed for this project. When asked what other ways they would be earning income if not on a BSAI boat, many responded that they would be concentrating on other fisheries. Many of the more highly experienced current participants in the BSAI crab fisheries stated that they tend to focus on the winter opilio season as opposed to participating in king crab. Two factors raised by interview subjects most likely explain this. Firstly, the lease fees are lower on opilio crab quota than king crab quota (around 50% as compared to 70%). Secondly, the opilio crab fishery occurs in winter months when there is less conflict with other fisheries. One Kodiak-based crew member spends October (during the king crab season) fishing halibut and he has not fished during a king crab season for several years. He notes that "the guys with the most experience fish opilio because they are fishing other fisheries during the other seasons" (crew, Akutan, No. 047).

An ex-crew member from Oregon who has moved into other fisheries says he would consider a 1 or 2 week trip to fish opilio a moderately attractive prospect, but it would have to be during the January opilio season because he had other fishing obligations during the king crab season. He says he is unlikely to go opilio fishing if he can survive with income from his other fishing because he does not find the opilio season as attractive, "because it is crappier weather, less money, and 60-66% lease fees off the top so you never hit $2…. You're fishing on $1.2, $1.1. then it's 3-5% of that for crew, so it would have to be a whole boat load to make it worth it." This crew member stopped fishing two years after rationalization was implemented because of the longer seasons which pushed into the longtime fisheries that he felt were ultimately a more lucrative investment. The 'jump off date' had been agreed to with his previous skipper, and he says "so I left and stayed longlining" (former crew, Oregon, No. 080).

Another ex-crab crewmember from Alaska explains that he was lucky to have investments in other fisheries that allowed him to transition when he was no longer able to work in the BSAI crab fisheries: "Quality crabbing was one of the best things that I [knew]. It's just the way it happened. Forced me out. Also forced me to pursue other economically successful pursuits. I don't think I can achieve my goals in the fishery anymore" (former crew, Dutch harbor, No. 019).

For others, it has been difficult to support a multi-fishery livelihood without participation in the BSAI crab fisheries. This is expressed by a former captain: "So crew are out of a job, guys who I've worked with for 28, 27, 29, and 41 years. They were with me in all different fisheries, but not anymore because we can't afford to crab" (former captain, Dutch Harbor, No. 064). A former crew in the BSAI crab fisheries explains that he fished crab every season between 1992-2003, as well as halibut and black cod. Now he says he makes $130,000 less than before rationalization by "scrambling" from one work opportunity to another: "Guys call me 'the butterfly'" (former crew, Oregon, No. 078).

Participation in multiple industries -- The relatively concise pre-rationalization crab seasons were conducive to multi-industry strategies that correspond to season or temporary land-based work. Landscaping, construction, and heavy machinery operations were the most frequently mentioned alternatives. Other jobs mentioned were ranch hand, ski patrol, car mechanic and helicopter pilot. Several people also held tugboat licenses. The multi-industry combination may have been what made participation in each sector viable. "If you look at what the traditional job was 3-5 years ago, some people just came in from carpentry, etc. for a couple of weeks – it's different for people that tendered when not on the crab boats" (processing plant employee, Kodiak, No. 034). In some cases, work outside of the fisheries represents an investment for the future that is currently subsidized by crab fishery earnings. Crab fishing is generally considered a profession for relatively younger men and thus long-term planning would need to entail other options. Skills such as engineering facilitate transition between fisheries and other industries (former captain, Seattle, No. 083).

Opportunities are constrained by location as well as by skills. An ex-crew member explained that following rationalization he no longer had a position on a boat and "so I started doing construction. But I thought about [going BSAI crab fishing again]…I would have gone fishing if the money was still there. If I was paid more, I'd still fish" (former crew, Akutan, No. 046). This emphasizes that fishing, including crab fishing, must remain competitive with other job opportunities, as emphasized by one Seattle-based skipper (boat owner, Seattle, No. 084). Regarding those who have left the fishing industries, one former captain notes that "most of the [crew I knew] have landed on their feet, but they are doing different things" (former captain Seattle, No. 068).

Effects structured by local opportunities -- The effects of fewer available crew positions following rationalization strongly depend on the locally available alternative opportunities. The metropolitan context of Seattle offers an economy that can more readily absorb those displaced from the BSAI crab fishery, but requires skills and an ability and willingness to be in. Retraining opportunities exist and have produced limited success. Seattle-based crew members who participate in the fishery may find year-round occupations through shipyard work or tendering opportunities. As mentioned above, a local economy may provide opportunities with which fishing positions must be competitive. As one former crab captain who is now participating in longlining fisheries explains, "I'd take a crab job, but it would have to offer more than I am making now" (former captain, Seattle, No. 083).

There is an immense variety among the local economies to which displaced crew may have recourse. At one extreme is the larger metropolitan area of Seattle. Rural Alaskan communities are also diverse, ranging from coastal to landlocked, CDQ and non-CDQ communities. For instance the community of Kodiak is characterized by its historical dependence on commercial fisheries. Indeed, as expressed by one crew member, "The only reason to be here is the fishing…"(crew, Kodiak, No. 031). Another Kodiak local relates that "I'm interested in fisheries where I can fish locally" (former crew, Kodiak, No. 023). A detailed examination of rationalization's impact on three Aleutians East

Borough communities is available in Lowe and Knapp (2006). Additional information on community impacts may be found in Lowe and Carothers (2008).

Many fisheries seasons in which fishing community residents participate are in conflict with the extended BSAI crab seasons. Fishing community-based crew may therefore find it particularly difficult to maintain the multi-fishery strategies that characterize their economy. Without income afforded by participation in the BSAI fisheries, however, many may struggle to make a viable income throughout the year with other fishing activities.

In Akutan an ex-crew member explains that: "I'll probably get into black cod that's open in the 3 miles around the island. That's enough." He says that there is more money doing cod, about 50 cents per pound which compares favorably with crabbing, which for him, is about $30,000 -35,000 per season. He continues, "I can do better sitting here than fishing [for crab]. Me and my dad do cod and halibut. It's close to home, and fuel costs are not so bad. If I wasn't fishing, I guess I'd be doing construction here" (former crew, Kodiak, No. 048). At the time of this research, two other ex crabbers were employed on a local construction project and some work opportunities may be afforded by Akutan's status as a CDQ community.

SUMMARY OF CONCLUSIONS

The purpose of the research reported here has been to understand how employment opportunities for commercial fishing vessel crew members have changed in the BSAI crab fisheries following the implementation of a quota-based management system by the NPFMC. We conducted 90 ethnographic interviews in several Alaska, Washington, and Oregon communities, comprising hundreds of hours of discussions with 134 current and former crew members, captains, boat owners, processing plant employees, and other stakeholders. Participants were selected using snowball and intercept sampling methods that were determined to be the best available options. We attempted to canvass a broad sample of the population, speaking with people along a continuum from those who perceive increased benefits under the rationalization program to those who feel deeply disenfranchised by it. While we have chosen to convey many direct quotes in this report, those selected for inclusion are not idiosyncratic anecdotes, but rather illustrations of commonly expressed sentiments, unless specifically noted otherwise. The importance of conveying crew perspectives, on which we focused, is underscored by many issues raised in the interviews which merit rigorous scientific inquiry. As such, the conclusions drawn from the information provided by crew in this report identify several testable hypotheses that can and will be pursued in future research to identify the validity of the common assertions.

The primary conclusion regarding how crew composition has been affected by rationalization is that the number of crew positions available in BSAI crab fisheries has significantly declined. A major portion of this contraction is due to vessel consolidation and a smaller portion can be attributed to the buyback that occurred prior to

rationalization. The majority of the decline has likely been aboard Seattle-based vessels, with significant decreases also aboard vessels home-ported in Alaska, Oregon, other Washington locations, and other states. Indirect evidence suggests that the overall proportion of positions by state remains the same. Around 20% of the vessels that left the crab fisheries entirely immediately after rationalization are still participating in other fisheries, and some vessels are earning more and others are earning less than when they fished for crab.

Separate from the number and distribution of crew positions, the types of positions available on vessels and tasks associated with those positions remain essentially the same as before rationalization, although there are significant changes to the structure of compensation and some likely changes to the types of individuals employed, possibly favoring a mix of older crew members with new entrants known as greenhorns. This trend suggests a more "bimodal" distribution of crew between greenhorns and veterans, than found in crew composition in the pre-rationalization period (as shown for Alaska crew licenses in all fisheries combined in Carothers and Sepez 2005). It will be very difficult (perhaps impossible) to obtain demographic information on former crew to bear on this issue. However, it may be possible to more definitively address changing demographics in the future through crew license number data contained in the EDRs if those numbers can be merged with the State of Alaska database on crew license demographics. Similarly, if the proposed crew participation data collection program currently being scoped by the State of Alaska is enacted such research could be viable.

The primary conclusions regarding employment opportunities are that hiring processes under the post-rationalization BSAI crab fisheries appear to remain very similar to those used prior to rationalization, although they are now manifested under new conditions and terms of employment. Hiring is largely carried out by captains, sometimes in consultation with crew members or vessel owners. Social networks and reputation (of person seeking employment and of the boat) may play a large role. There are different strategies when it comes to crew qualifications. Some captains will try to hire the most experienced people available. Others will adopt a strategy of hiring inexperienced people who can be specifically trained. This explains in part why, in spite of a surplus of unemployed but highly qualified and experienced crew members, greenhorns are still hired. The persistence of the greenhorn position under these conditions is also explained by the pay structure: less experienced crew may be paid relatively less thus leaving more of the net revenues to be allocated to crew shares for more experienced members. Another very important factor is that experienced crew may not want to work for the significantly diminished returns per unit of effort on vessels with high quota lease rates; such vessels typically charge royalties to crew on the purchased or leased shares which leads to lower net revenues earned per pound by the crew on the additional crab, lowering their average compensation per pound of crab during the trip.

Related to these issues is a perceived increase in vessel expenditure (factor) shares for capital (to buy quota) and decreased shares for labor. Such a shift is consistent with a decreased emphasis on having the best, fastest crew to maximize vessel returns (which was important in a derby fishery). Now, since the catch is essentially guaranteed, the

returns to the vessel may be maximized by utilizing the economies of scale on the vessel and leasing/purchasing quota to bring in greater revenues to cover the fixed costs of the vessel (lowering average variable costs).

C-shares are seen as important investments in the fishery that allow captains to make financial investments and may be their incentive to stay in the fishery. Crew emphasized that enhanced access to C shares would have similar benefits for them. A crew employment decision model based upon the considerations expressed by interviewees illustrates the cognitive process involved in deciding whether or not to seek employment in the BSAI crab fishery. The model includes considerations of financial need, relative, potential compensation, temporal investment, alternative opportunities, and future considerations.

The primary conclusions regarding characteristics of work in the rationalized BSAI fisheries are that they appear to have changed significantly under rationalization in terms of pay structure, season length, processor influence, safety at sea, and the interactions between these factors. The impacts on work in the fisheries are extremely diverse and complex, and effects of consolidation, quota leases, season length, crew experience, and safety are easily conflated. We make an attempt to describe these factors individually while also recognizing their interrelatedness.

Quota acquisition and consolidation is an outcome of rationalization that has facilitated vessel consolidation and thus lowered the total fleet costs of landing each year's total allowable catch. The profit margin for crab that are fished with quota that is leased or purchased is much less than for crab fished with quota that was given through the allocation, and so the return on the additional crab is lower for both crew and the vessel owner(s). The lease rates quoted by interviewees during this research were around 70% for king crab and around 50-60% for opilio crab. In turn, depending on the extent to which a boat fishes their allocated quota versus purchased or leased quota, crew can experience a diminished rate of compensation per unit of crew effort compared to pre-rationalization rates. From the vessel owners' perspectives and observed behavior it appears clear that it is often financially worthwhile to acquire additional quota, but crew often conveyed the opposite opinion in the interviews. As illustrated in the decision model and several quotes included in this report, crew may decide not to work on a boat with higher royalty charges.

Longer seasons are another consequence of transition to a quota-based fishery. Longer seasons may provide greater job security and contribute to a "professionalization" of the BSAI crab fisheries. However, longer seasons can create potentially insurmountable scheduling conflicts for those who also participate in other fisheries. To accommodate the longer seasons and avoid idle plant time, many processing plants have developed delivery schedules which have reportedly had the effect of dictating the pace of fishing. While some find this agreeable, others feel that the open access "race for fish" has been replaced with an equally hazardous "race to the processors" in order to meet offload dates and avoid associated penalties. Thus, the need to meet delivery schedules may diminish the safety benefits associated with ending the race for fish. The net effect of rationalization

on safety can be more rigorously examined by utilizing U.S. Coast Guard data on both accidents and fatalities. There have been no fatalities in the 3 years post-rationalization. However, a longer time series may be required to estimate the effects of the program on accidents and fatalities in a rigorous, quantitative manner with sufficient statistical confidence.

Safety aside, interviewees have suggested that the combination of longer seasons and diminished per-unit profitability associated with leased or purchased quota have decreased compensation to crew when examined in a per-pound or per-day metric, but may have increased in total (due to greater landings per vessel through quota consolidation) (Abbott et al. 2010). Similarly, the share payments to crew as a percentage of total vessels costs may have declined as well, reflecting a shift in factor shares between capital and labor. Price declines and fuel price increases following the implementation of the program have also decreased the compensation available for vessel owners and crew, exacerbating concerns about income earned in the fishery. These hypotheses will be tested in future analysis using the EDR data on the costs and crew compensation present in the crab fisheries.

Finally, the primary conclusions regarding alternative and additional employment opportunities are that these may deeply affect crew members' abilities and decisions to participate in the BSAI crab fisheries. Multi-fishery and even multi-industry job portfolios (common among crew) are more difficult to accommodate with longer crab fishing seasons and other obligations to the boat which now extend across several months. The effects following from fewer available crew positions as an outcome of the rationalization (and to a lesser extent, the buyback) are strongly dependent upon locally available alternative opportunities. Crucially, fishing community-based crew may find it particularly difficult to maintain the multi-fishery strategies that characterize their economy. Without the income afforded by participation in the past BSAI fisheries, many may struggle to make a viable income throughout the year with other fishing activities.

RECOMMENDATIONS FOR FURTHER RESEARCH

- Operationalize the CPUCE and calculate it for different fisheries. This will require information on pre-season shipyard work in the pre- and post-rationalization periods.
- Examine differences in crew remuneration on leased shares and initial issuance shares.
- More formally investigate the postulated bimodal distribution of crew years of experience.
- Estimate the number of individuals participating in crab fisheries based on EDR data, including a quantitative assessment of the extent of potential underreporting in the pre-rationalization data.
- Study the role of tendering, particularly explaining the decrease in the first two years following rationalization and the increase in the third year of rationalization.

- Examine whether crab crew exhibit fidelity to a vessel across different fisheries during the year and estimate the usual rate of in-season turnover.
- Further investigate the presence of multi-fishery participation by vessels and individuals.
- Examine the post-rationalization trends in the age demographics of crew members. Age data could potentially be generated by cross-tabulating information on individual crew in the Economic data Reports with the ADF&G crewmember license data, which contains birth date information.

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