CHANGES IN THE DISTRIBUTION OF THE ALASKA FISHERIES

By Dr. Ben Muse

LCDR Jan C. Manwaring: Our first presenter is Dr. Ben Muse, whose presentation is entitled *Changes in the Distribution of the Alaska Fisheries*. Dr. Muse has a doctorate in agricultural economics from Cornell University and has worked at the Alaska Commercial Fisheries Entry Commission as an economist for 12 years. He is also an adjunct professor at the University of Alaska Southeast. Dr. Ben Muse:

My topic is *Changes in the Distribution of Alaska Fisheries*. I am interested in changes in the size of the different fishing industry segments, such as the shellfish fishery and the salmon fishery, off Alaska.

As an indicator of the size of the segments, I am going to focus on estimates of employment in each segment, rather than on estimates of the physical volume or value of fish products. This focus on the number of people at risk, and on the amount of time they are at risk, is more directly related to safety.[1]

This paper is organized on the basis of statistics supplied to me in August by Richard D. Kennedy of the National Institute for Occupational Safety and Health. Figure 1 shows Alaskan commercial fishing fatalities from January 1, 1991, to August 11, 1992. During this period there were 28 fatalities in crab, ten in salmon, eight in black cod and pollock, and four in halibut. Since August there have been more fatalities in the halibut fishery.

In line with these statistics, my paper has three parts. I am going to discuss the shellfish fishery because that accounts for about 50 percent of those fatalities, I am going to discuss salmon; and finally, I am going to discuss black cod, pollock, and halibut together as one groundfish category. This approach ignores some important fisheries, such as herring, but it focuses on fisheries that fatality statistics suggest may be important.

METHODOLOGY

I will use estimates of two measures of employment in Alaska's fisheries: numbers of persons employed and the number of person-years of employment. The numbers of persons employed will be used to study the salmon fisheries, while the

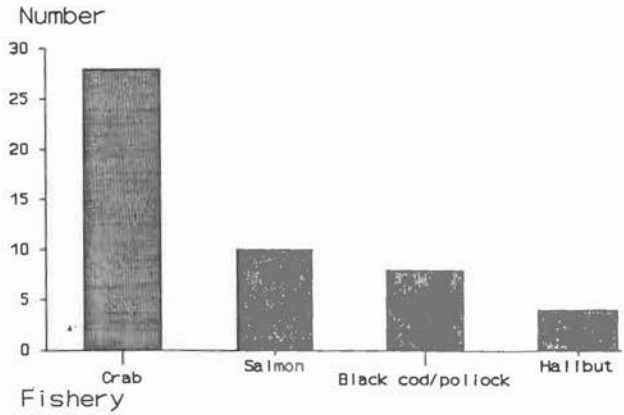

Figure 1. Commercial Fishing Fatalities.
—Alaska, January 1, 1991–August 11, 1992

number of person-years will be used to study the shellfish and groundfish fisheries.

The estimates of numbers of persons employed were made for this paper with information on numbers of fishing permits used in different fisheries and average crew size estimates. The estimates of person-years of employment come from two sources; some were made by me for this paper and others come from a 1987 Alaska Department of Labor report by Thomas.[2]

The approaches used here to estimate person-years of employment essentially add up the number of separate months in which each fishing permit was used to make a landing in a fishery, multiply this sum by an average crew size for the fishery, and then divide the result by twelve. Note that if a permit was only used in part of a month, this method still assigns a full month of fishing.

These results were adjusted to deal with double counting. If a permit holder fishes for halibut and sablefish in the same month, the approach that I just described will produce two separate months of activity by that permit holder when actually there was only one month of activity.

Thomas and I used different approaches to double counting. Thomas appears to have only kept the activity in the fishery with the highest gross revenues. I tried to incorporate an average crew size for the multiple fisheries.

We also may have differed in our definitions of the fisheries. Tests of the two methods for the same years suggested that for most fisheries, Thomas' approach was slightly more conservative, but the methods were not generally far apart. The biggest difference appeared to occur in the sablefish longline fishery.

The "person-years" measure of employment used here differs somewhat from measures used by other analysts. For example, the measure discussed here does not take explicit account of work other than the fishing itself. This work can take place before or after the season and can include finding markets, maintaining vessels and gear, and taking care of accounting.[3]

In addition, person-years are not exactly comparable to the "full-time equivalents" or FTEs estimated by some other analysts. For example, a study estimating full-time equivalents will try to account more explicitly for the length of a working day.[4]

Despite these limitations, person-years of employment, as estimated here, are useful:

- First, to some extent it implicitly includes work done before and after fishing activity. This occurs because any landing by a permit holder during a month will generate a month of fishing activity, whether or not fishing effort takes a full month.
- Second, to the extent that it does not include work before and after the season, it may provide a more accurate measure of employment on the water, presumably the time of maximal risk in fishing operations.
- Third, the estimates made here provide useful information on trends in employment in different fisheries.

SHELLFISH FISHERIES

The shellfish fisheries include the various fisheries for king, tanner, and dungeness crab and shrimp. Table I shows shellfish employment in person-years for the shellfish fisheries statewide, and for the shellfish fisheries in Western Alaska. The statewide data and Western Alaska data for the period from 1977 to 1984 are from Thomas. The statewide data and Western Alaska data in

1986, 1988, and 1990 were estimated for this paper.

> This focus on the number of people at risk, and on the amount of time they are at risk, is more directly related to safety.

Table I also suggests that statewide shellfish employment tended to rise from 1977 to 1982, tended to fall from 1982 to the mid-eighties, and then began to recover, although not fully to the earlier levels. Western Alaska shellfish employment appears to have followed a similar pattern, although the recovery has been relatively stronger.

Table I. Shellfish Fishery Employment.

Year	All Alaska	Western Alaska
1977	1,139	426
1978	1,335	649
1979	1,454	568
1980	1,383	698
1981	1,486	688
1982	1,530	690
1983	1,418	627
1984	1,177	581
1986	969	454
1988	1,188	637
1990	1,207	754

An important part of the Western Alaska fishery, especially in the late seventies and early eighties, was the Bristol Bay king crab fishery. This fishery peaked in the 1980-81 season when the fishermen landed 130 million pounds.

The fishery collapsed after that, and by 1983-84, there was no fishery. Since then, the shellfish fishery in Western Alaska has come back, fueled by an expansion in the opilio tanner crab fishery in the Bering Sea. In 1990, opilio landings alone came to 162 million pounds. If these employment estimates are correct, the current shellfish fisheries are producing more employment in Western Alaska than the boom of 1980.

There has also been a change in the regional distribution of shellfish-fishing jobs. In 1980, there were about 1,400 person-years of employment throughout the state and about 700 in Western Alaska. Thus, there were about 700 person-years of employment outside of Western Alaska.

In 1990, there were 1,200 person-years throughout the state and about 750 in Western Alaska. This implies that in 1990 there were only about 450 person-years outside of Western Alaska.

Alaska Department of Fish and Game reports on landings and production show large declines in shellfish fisheries outside Western Alaska. These declines take place in most of the king, tanner, dungeness, and shrimp fisheries in Kodiak, Cook Inlet, and Prince William Sound. One exception has been a small boom in the Southeast Alaska dungeness crab and pot shrimp fisheries.

SALMON FISHERIES

I will discuss the salmon fisheries next. Table II shows estimates of the numbers of separate persons operating each of the separate gears used in the salmon fisheries: drift gillnets, purse seines, set gillnets, and hand-and power-troll gear.

Each year's estimates were made by multiplying the numbers of permits fished in each fishery by an average crew size for each fishery.[5] Table II shows several interesting things:

- First, there were large employment increases in each of these fisheries at some point in the

late seventies. This is associated with relatively rapid increases in the percentages of limited entry permits being fished in the early years of the limited entry program. The drift and set gillnet fisheries are particularly affected by increases in the numbers of permits being fished in the large Bristol Bay fisheries. The employment increase in the troll fishery in the seventies is probably associated with strategic behavior by persons anticipating hand-troll entry limitation.

- Second, there have been continuing upward trends in the numbers of persons employed in the set gillnet and drift gillnet fisheries during the eighties, while employment in the seine fishery has been relatively stable since 1978, and the numbers of persons employed in the troll fisheries have been declining since 1978.[6]
- Third, several of these fisheries had a large decline in employment in 1989. That is the year the *Exxon Valdez* oil spill disrupted salmon fisheries from Prince William Sound west to Chignik.

The declining employment in the hand-and power-troll fisheries of Southeast Alaska contrasts with the trends observed in the other salmon fisheries. There are probably two factors contributing to this:

- First, many of the hand-troll permits are non-transferable and expire when the person holding them leaves the fishery.
- Second, the amount of time available for harvesting king salmon with troll gear dropped during the period. For example, in 1980 the king salmon summer fishery was open for 149 days. In 1990 it was open for 24 days.

Because fixed crew sizes were used to make these employment estimates, the increases in estimated employment do not reflect changes in average crew sizes. I chose crew

Table II. Salmon Fishery Employment.

Year	Total Number of Persons Employed				Total Number of Person Years			
	Drift Gillnet	Purse Seine	Set Gillnet	Troll	Drift Gillnet	Purse Seine	Set Gillnet	Troll
1977	6,077	5,057	6,506	3,149	1,150	1,090	1,555	852
1978	6,832	5,542	7,192	4,052	1,409	1,201	1,844	1,074
1979	7,179	5,483	7,469	3,640	1,441	1,256	1,934	982
1980	7,096	5,581	7,480	3,140	1,413	1,101	1,519	887
1981	7,316	5,711	7,697	2,541	1,602	1,263	1,647	780
1982	7,355	5,676	7,692	2,484	1,632	1,259	1,658	802
1983	7,387	5,573	7,761	2,364	1,588	1,176	1,588	822
1984	7,399	5,550	7,753	2,251	1,689	1,262	1,689	764
1985	7,468	5,383	7,829	2,355				
1986	7,515	5,406	7,900	2,251				853
1987	7,519	5,553	7,939	2,212				
1988	7,563	5,726	8,168	2,226	1,749	1,423	1,844	
1989	6,405	4,231	7,894	2,146				
1990	7,626	5,742	8,184	2,167	1,674	1,335	1,721	720

sizes that were prepared by the Alaska Department of Labor in the early 1980's. However, crew sizes can change through time.

Economics suggests that if the fishery is profitable, fishermen invest more capital and hire more labor. If a fishery was not profitable, crew sizes might shrink along with other measures of fishing effort.

GROUNDFISH FISHERIES

Finally I want to discuss the various fleets fishing groundfish species such as halibut, sablefish, flounder, cod, and pollock. I have divided the groundfish industry into five parts: vessels delivering in Alaska, vessels delivering to mother ships at sea, factory trawlers, freezer longliners, and joint ventures.

Table III shows estimates of the numbers of person-years used in three parts of the industry delivering fish in Alaska: the halibut fishery, the sablefish fishery, and the fishery for other groundfish. The sablefish and halibut fisheries are mainly longline operations, the fishery for other groundfish mainly uses longlines, trawls, and pots.

Table III suggests that employment was stable or trending upward in the late seventies and early eighties, and that employment began to increase rapidly in the mid to late eighties. The estimates for the years 1977 to 1984 are from Thomas. The estimates for 1986, 1988, and 1990 were made for this paper.

The estimates for the "other groundfish" fishery cover employment with several gears. An important element in the increase in employment in this fishery has been an expansion in its statewide otter trawl component. State records show no more than 49 permits were used in this fishery prior to 1982, and no more than 98 permits prior to 1987.

After 1987 there are large increases in the numbers of permits fished in this fishery. From 92 permits in 1986, the number fished jumps to 186 in 1987 and rises to 353 in 1990. Production also increases; the total pounds landed in 1990 was almost 20 times total pounds landed in 1986.

Table III. Groundfish Employment Summary.

Year	General Groundfish	Halibut	Sablefish
1977	25	507	46
1978	37	525	47
1979	52	702	108
1980	57	721	51
1981	75	620	34
1982	111	849	43
1983	138	931	98
1984	176	930	155
1986		1,270	203
1988	759	2,270	525
1990	860	2,095	409

The expansion in employment in the halibut fishery appears to have come, to a great extent, in the large vessel component of the fleet. The numbers of halibut permits for vessels under 30 feet that were fished were fairly stable during the late eighties, but the number of permits for vessels greater than 30 feet that were fished rose dramatically during this period. The expansion in numbers of person-years in halibut is especially striking since it has occurred despite a shortening of the halibut fishing season over the time period.

The numbers in Table III may tend to overstate actual employment due to double counting and short halibut seasons. The employment estimates in this figure are subject to

a certain amount of double counting. These are situations where it might be very common for someone to have used sablefish and other groundfish permits in the same month. As noted earlier, Thomas's approach to double counting appears to be somewhat more conservative than mine, particularly for sablefish.

Short halibut fishing seasons may also lead to an overestimate of fishing employment. Halibut seasons have been very short during this period; often they last only a few days. Assigning a full month of fishing activity if one landing is made in a month may lead to overestimates of person-years of employment.

Groundfish caught off Alaska are often delivered to motherships for processing or are caught and processed by factory trawlers and freezer longliners. In these cases the fish are not delivered to an Alaskan port.

Data readily available to me on these fisheries are not as good as the records from the fisheries discussed earlier. I will provide "back of the envelope" estimates of employment in 1990. These estimates are very tentative. However, when compared to 1980, when these fisheries were not significant, they will provide a rough idea of the scale of growth in these fishery sectors during the eighties.

Table IV summarizes estimates of the numbers of separate motherships, factory trawlers, and freezer longliners that reported harvests during 1990. The column labeled "Vessel Months" shows the number of separate months in which vessels in each category reported harvests. Ten vessels, each reporting harvests in two months, would produce 20 vessel months of activity.

The factory trawler fleet consists of larger boats that can process their catch on board. My information on crew sizes is not good. Some information suggests an average of 50 persons is plausible. If average crew sizes were equal to 50 persons, the 607 vessel months of fishing activity by factory trawlers in 1990 imply 2,529 person-years of employment.

The freezer longliner fleet has also expanded in the past few years. If crew sizes were about 20 persons, the 260 separate months of activity in 1990 imply 433 person-years of employment.

Table IV. Offshore Groundfish Activity Estimates.

Type of Operation	Vessels Active	Vessel Months
Hook and line motherships	8	211
Trawler motherships	11	62
Hook and line catcher-processors	28	260
Trawler catcher-processors	65	607

Source: Personal communication from David Colpo, National Marine Fisheries Service, Seattle.

Motherships accept fish for processing from an associated fleet of trawlers or longliners. My information on crew sizes in this fleet is even poorer than for the factory trawlers and freezer longliners. I have assumed that the trawler motherships typically employed 150 persons on board the mothership and the associated trawlers.

I have been unable to get any information on longline mothership crew sizes. If the information on trawler mothership crew sizes is correct, they may provide 775 person-years of employment. Employment on longline mothership operations would add to this.

The joint venture fleet that operated in the eighties used U.S. harvesters who delivered at sea to foreign

processing vessels. The joint venture fleet is gone now; it has not operated since 1990. It peaked in 1987. In 1986, a year close to the peak, McDowell et al. estimated that it provided about 550 years of full time equivalent employment to U.S. fishermen.[7]

SUMMARY

To summarize this paper:

1. Person-years of shellfish fishery employment in Western Alaska fell from the early to the mid-eighties and recovered in the late eighties.
2. Person-years of shellfish employment elsewhere in the state tended to fall between the early and late eighties.
3. The numbers of persons employed in the salmon drift gillnet and set gillnet fisheries tended to rise during the eighties.
4. The numbers of persons employed in the salmon seine fishery did not have a strong trend during the period.
5. The numbers of persons employed in the salmon troll fishery fell during the eighties.
6. Person-years of employment in groundfish fisheries delivering to shore rose during the eighties, particularly in the late eighties.
7. There was a general tendency for person-years of employment in groundfish factory trawlers, freezer longliners, and operations delivering to motherships to rise in the eighties.
8. Joint venture operations peaked and disappeared during the period. □

NOTES AND REFERENCES

1. I would like to thank Richard Kennedy of the National Institute for Occupational Safety and Health, Elaine Dinneford and Susan Shirley of the Alaska Commercial Fisheries Entry Commission, and Dave Colpo of NMFS, for help with this paper. That help includes valuable insights into the fisheries. They are not responsible for errors in this paper.

2. Thomas, Kathleen. *Alaska Seafood Industry Employment, 1977-1984*. Alaska Department of Labor. Juneau: June, 1987.

3. For an analysis that takes explicit account of work in addition to fishing see Eric McDowell, et al, *Alaska Seafood Industry Study*. The McDowell Group. Juneau: May, 1989.

4. For an example of this approach see the report, *Economic Impacts of the North Pacific Factory Trawler Fleet*, by Frank Feeman and Michael Hubbard. A report by the consulting firm Coopers & Lybrand for the Alaska Factory Trawler Assoc. Seattle: January, 1990.

5. Note that the figure shows estimates of numbers of persons employed, not person-years of employment.

6. Other data suggest that the number of person-years of employment have been rising since 1978 for drift and set gillnets and for seiners, and dropping for trollers.

7. McDowell et al., page A-14. As noted earlier, FTEs and the person-year concept used in this paper are not fully equivalent. McDowell et al. also try to include estimates of time spent doing work in support of fishing activity.

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