

## An Empirical Study of Limited Entry in Alaska's Salmon Fisheries

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### INTRODUCTION

As one of the few remaining natural resources to have virtually free access, the fisheries have recently received considerable attention from social scientists. A general theory developed by economists argues that without limits on access, the fisheries will employ more inputs of labor and capital than necessary to harvest the resource (Crutchfield and Pontecorvo, 1969). It is argued that this results in a loss to the economy both because of incorrect factor allocation and because the potential economic rent derived from the fisheries could accrue to the custodians of the resource. Accordingly, the solution to the problem is to reduce the inputs of labor and capital to a point where the marginal cost of an additional unit of fishing effort just equals the revenue it produces.

More recently, several economists, sociologists, and others have questioned the wisdom of restricting access to the fisheries. Their concern is that the social upheaval caused by displacing persons with little employment opportunity outside the fisheries may not justify the gains to be derived by increased economic efficiency (Bishop, 1973; Huq, 1971).

Empirical evidence collected by the State of Alaska both before and after passing limited entry legislation in 1973 strongly suggests that, first, limited entry or controlled access is necessary for reasons other than those suggested

by a narrow concept of economic efficiency, and second, rather than causing social upheaval, limited entry can alleviate social distress if applied wisely.

It is suggested that the evidence collected in Alaska's salmon fisheries may characterize many high value coastal fisheries of the United States.

### EARNINGS OF SALMON VESSELS

In economic theory a factor of production will not be employed in the production of a certain commodity unless

the remuneration it receives at least equals the compensation that could be earned in alternative employment. According to this theory, capital and labor will stop entering a fishery once every factor of production is employed at an "opportunity" wage.

Evidence shows that this is not the case in Alaska's salmon fisheries. During the spring of 1974, Alaska's Commercial Fisheries Entry Commission

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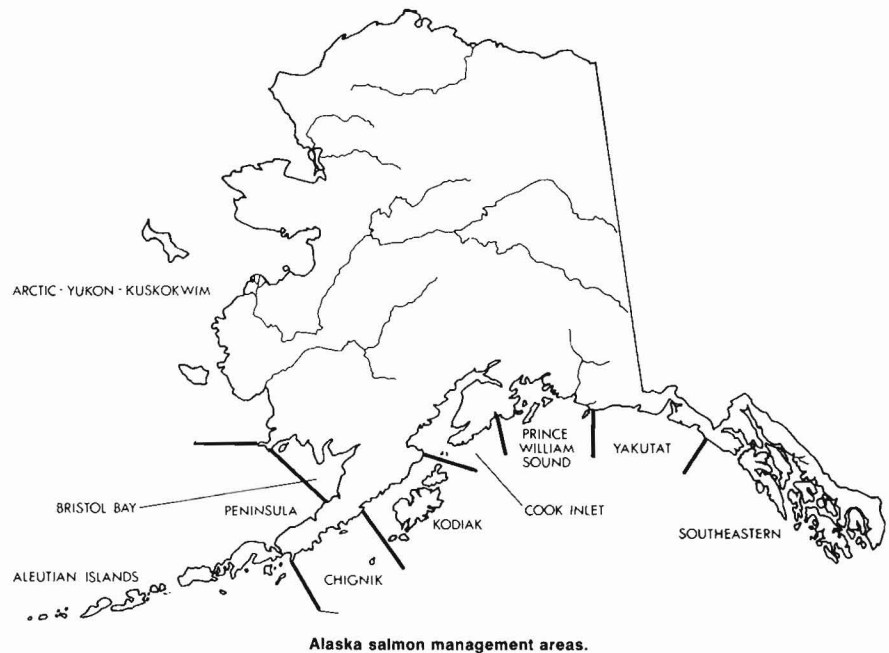


Table 1.—Analysis from landing records and interviews with active commercial fishermen for the years 1969-73.

Area	5-year average gross earnings	Deflated 1973 operating costs, fixed costs, and depreciation <sup>1</sup>	Labor costs <sup>1</sup>	Net earnings
Southeastern purse seine	\$28,380	\$7,485	\$11,825	\$9,070
Southeastern drift gill net	10,365	3,189	1,712	5,464
Power troll <sup>2</sup>	5,689	3,259	1,934	496
Prince William Sound drift gill net	5,777	3,230	1,642	905
Prince William Sound purse seine <sup>3</sup>	18,037	3,196	8,116	6,725
Cook Inlet drift gill net	4,430	1,998	1,004	1,428
Cook Inlet set gill net	2,854	2,109	1,227	-482
Kodiak purse seine	15,569	3,498	6,869	5,202
Bristol Bay drift gill net	7,309	1,367	2,777	3,165
Bristol Bay set gill net	2,080	735	458	887

<sup>1</sup>For vessels participating in several fisheries costs have been prorated. Operating costs such as fuel and food are prorated on the basis of time fished. Fixed costs, such as insurance, have been prorated on the basis of gross earnings. Crew shares and certain repairs have been derived for the specific fishery examined.

<sup>2</sup>1973 data only.

<sup>3</sup>Not open in 1972.

analyzed computerized landing records collected by the Alaska Department of Fish and Game for the years 1969-73 and conducted field interviews of 520 active commercial fishermen (Owers, 1974). Table 1 summarizes the results for the more important salmon fisheries in the state. Each fishery is a relatively homogeneous unit since a fisherman must buy a gear license for a specific type of gear in one area only, although there are a number of fishermen who fish multiple gear types. Earnings fluctuate widely, depending upon the size of the salmon runs and prices paid; therefore, gross earnings have been averaged over the 5-year period. In deriving costs of operation, all costs have been prorated to each specific fishery based on time fished and percentage of gross earnings received. Costs, which were collected by interview for 1973 only, have been extrapolated over the 5-year period and deflated by the Consumer Price Index. Labor costs are for crew members only. "Net Earnings" includes a return to the operator's labor, management, and investment.

As can be seen, the level of net earnings is very low in many of the fisheries. When one considers prevailing rates of interest, many operators would have made more money by selling their vessels and gear, investing the proceeds, and living on interest payments or dividends. The remuneration for their labor in these fisheries, in other words, was actually less than zero. Wages in industries which could logically be considered alternatives to commercial fishing in Alaska provided far higher in-

comes. For example, in 1973 the average wage earner in the contract construction industry earned \$8,175, and those in the timber industry earned \$6,490 in the months from May through September, the period which roughly coincides with the salmon fisheries.

### PROFESSIONALISM IN THE SALMON FISHERIES

Low fishing earnings suggest that for many individuals commercial fishing is not their main source of income. Licensing and other data collected by the State of Alaska support this conclusion and further indicate that there are fundamental differences between vocational fishermen and others in the harvesting segment of the industry.

Table 2 shows the turnover in licensing that occurred in the salmon fisheries

It is apparent that there is a very large turnover in licenses from year to year. With the exception of the Southeastern (Alaska) purse seine fishery, over half of the fishermen fished only 2 years between 1969 and 1972, and one-third fished only 1 year. Some license turnover can be explained by the fact that individuals may shift from one type of gear or area to another, depending on run forecasts or other reasons; nevertheless, it remains true that most are caused by individuals actually leaving or entering the fisheries. Based on this data, it is fair to assume that a large segment of Alaska's salmon fishermen have relatively high labor mobility.

Besides a rapid turnover in licenses, data show that within a given fishing season many fishermen participate only a short time. Table 3 shows the percentage distribution by fishery for the total number of vessels which fished in 1972. Many of the fisheries in the State last only a few months, yet there were still a large number of fishermen who fished half or less of the total fishing time available, usually at the peak of the salmon runs. Many of these individuals fish only during vacations or on weekends.

As part of a study of fishermen's incomes, the Internal Revenue Service (IRS) agreed to study tax returns submitted by 20 percent of the individuals who fished in Alaska, including nonresidents, in 1971 and 1972. Since IRS data is confidential, the survey was designed in such a way that individual identities were not revealed to the Commission. The survey compared nonfishing occupational income, or in other words,

Table 2.—License turnover. Percent of total that fished any time between 1969-1972, by fishery.

Area	Fished 1 year only	Fished 2 years	Fished 3 years	Fished all 4 years
Southeastern purse seine	25	17	18	41
Southeastern drift gill net	44	15	14	27
Power troll	45	22	20	13
Prince William Sound purse seine <sup>1</sup>	34	20	46	—
Prince William Sound drift gill net	36	17	14	32
Cook Inlet drift gill net	42	23	15	20
Cook Inlet set gill net	46	28	18	8
Kodiak purse seine	41	16	13	30
Bristol Bay drift gill net	34	18	16	31
Bristol Bay set gill net	52	27	12	8

<sup>1</sup>Was only open 3 years (not open in 1972).

between the years 1969 and 1972. The data includes only those people who actually fished since approximately 10-20 percent of the licenses sold in the State each year are never used.

earned income received from employment outside of fishing (investments, pensions, transfer payments, etc. were not included) with gross earnings received from fishing. The actual formula

**Table 3.—Active participation—1972. Percent of total number of vessels that participated, by fishery.**

Area	3 weeks or less	4-6 weeks	7-9 weeks	10-12 weeks	13 weeks or more
Southeastern purse seine	3	4	46	42	4
Southeastern drift gill net	9	10	14	20	47
Power troll <sup>1</sup>	—	—	—	—	—
Prince William Sound purse seine <sup>2</sup>	9	69	22	—	—
Prince William Sound drift gill net	18	18	21	34	9
Cook Inlet drift gill net	32	63	5	—	—
Cook Inlet set gill net	32	19	34	12	3
Kodiak purse seine	21	55	23	1	—
Bristol Bay drift gill net	44	40	12	3	—
Bristol Bay set gill net	59	37	3	—	—

<sup>1</sup>Data not yet available.

<sup>2</sup>Data for 1971.

**Table 4.—Income dependence—1972. Comparison between fishermen with different length history of participation.**

	Fished 1 year only	Fished 3 or more years
	Percent	
Southeastern purse seine	75.0	90.5
Southeastern drift gill net	59.0	88.6
Power troll	50.5	75.5
Prince William Sound purse seine <sup>1</sup>	—	—
Prince William Sound drift gill net	59.0	77.4
Cook Inlet drift gill net	54.4	58.9
Cook Inlet set gill net	30.4	46.2
Kodiak purse seine	60.6	73.8
Bristol Bay drift gill net	30.3	33.6
Bristol Bay set gill net	32.9	62.8

<sup>1</sup>Not open in 1972.

used was gross earnings received from the fishery being studied, divided by the sum of gross earnings and nonfishing occupational income. The results were multiplied by 100 to derive an "Income Dependence Percentage" and stratified by the length of time individuals had fished.

One would suspect that fishermen who have fished several years are more economically dependent on commercial fishing than those who have fished only a short period of time. As Table 4 confirms in all cases, those who fished 1 year showed less dependence upon commercial fishing than those who fished 3 years or more. The actual magnitude of the difference would have been greater had net earnings from fishing been used instead of gross earnings. Those fisheries which have high average gross earnings tend to push all figures toward the high end of the scale.

Not shown, but also of interest, is the distribution of gross earnings in the fisheries. Rather than a bell shaped distribution or one skewed to the left (indicating a high concentration of dependent fishermen with a steady decline into levels of less dependence), the distribution in many fisheries is a U-shaped

curve with concentrations of individuals at both ends of the scale. This indicates that fishermen tend to be either dependent upon commercial fishing or else not dependent at all.

### IMPLICATIONS FOR LIMITED ENTRY

It is obvious that as more fishermen attempt to harvest a fixed level of total catch, the share to each individual fisherman is reduced in proportion to the number who participate. Not so obvious, however, as the empirical data suggests, is the fact that there is no self-regulating mechanism limiting the number of fishermen at a level that will provide an adequate income as long as a large segment of the industry is highly mobile or has little economic dependence upon commercial fishing. In these circumstances uncontrolled entry virtually guarantees impoverishment for many vocational fishermen who live in remote areas or who through age, lack of training, or other reasons exhibit low labor mobility. Any increase in their earnings is quickly dissipated by new entrants.

The scheme chosen for controlling entry should be closely tailored to the

needs of the fishery. Among the means suggested for limited entry have been direct control of licenses, taxes or fees to discourage entry, and direct quotas on individual fishermen (Christy, 1974). A system of taxation or fees would in effect force vocational fishermen to pay the cost of eliminating nondependent fishermen. Since low earnings do not seem to discourage new entrants, a tax or fee would probably have to be quite high in order to be an effective deterrent to entry and could be beyond the ability of many vocational fishermen to pay. The feasibility of administering a quota system on individual fishermen when dealing with a highly cyclic resource with thousands of participants is virtually impossible.

The data presented here strongly suggest that a program to control licenses is the most effective method for limiting entrants to Alaska's salmon fisheries and, in fact, is the method that is being used by the State. In contrast to a system of taxes or fees, under a licensing system, the initial issuance of licenses can favor vocational fishermen using objective, standardized criteria. A licensing system also insures that the immediate benefits of a limited entry program pass on to the fishermen. Low earnings in Alaska's salmon fisheries make this an urgent consideration.

### EFFECT OF LICENSE LIMITATION ON INCOMES

Evidence that a scheme to control licenses will increase incomes to participants comes from two sources. In British Columbia, where a license limitation program has been in effect since 1968, average gross earnings to fishermen have more than tripled (Campbell, 1974). In part, this is caused by a rapid rise in fish prices and good salmon runs; however, there is little question that without limited entry, increased earnings would have been quickly dissipated by new participants. In Alaska, for example, sales of commercial gear licenses are very closely related to the projected size of the salmon runs (Anonymous, 1973).

Earnings in Alaska's salmon fisheries which have not deteriorated are in those fisheries which have maintained stable

levels of gear. This has occurred in salmon fisheries, which require relatively large investments in order to compete successfully. In effect, large investments discourage new participants and have acted as barriers to entry.

## CONCLUSIONS

The empirical evidence gathered in an analysis of Alaska's salmon fisheries indicates that fishermen's earnings are, in many cases, below opportunity incomes. Furthermore, there is no self-correcting mechanism for assuring adequate incomes as long as a large percentage of fishermen have little economic dependence upon commercial fishing.

The data indicate that there are sufficient differences between voca-

tional and others in the fisheries that a method of controlling licenses into Alaska's salmon fisheries can be based upon objective, standardized criteria designed to favor those most economically dependent on commercial fishing. Stabilizing or reducing the level of gear in the fisheries will result in increased incomes to vocational fishermen.

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