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The Economic Performance of Oregon's Commercial Fishermen in 1972

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INTRODUCTION

This paper provides industry and government personnel with detailed information on the economic performance of Oregon's fishermen engaged in commercial fishing during the 1972 season. Specifically, the paper covers: 1) socioeconomic characteristics of fishermen; 2) costs and returns of commercial fishing; 3) production functions of commercial fisheries; and 4) fishermen's income from fishery and nonfishery employment.

These data are important to policy makers. Under the Fishery Conservation and Management Act of 1976, management of fishery resources will require socioeconomic data and analyses because of their inclusion in addition to biological consideration embodied in maximum sustainable yield. Financial institutions also need information about costs and returns. In addition, these data are useful to boat owners and skippers as benchmarks for comparing their costs and returns with those of average fishermen. These data comparing fishing and nonfishing income from part-time and full-time fishermen could be useful to fishermen and potential fishermen in their choice of occupation.

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DATA SOURCE AND DESCRIPTION

The data used in this study were derived from a survey designed to obtain knowledge of the operations and performance of Oregon's commercial fishermen. All Oregon skippers in the major fisheries constituted the "population" of the survey. An Oregon skipper was defined as a boat captain who had a commercial fishing license and resided in Oregon. The seven types of fishermen surveyed were:

renewal salmon — fishermen who trolled for salmon in both 1971 and 1972.

entry salmon — fisherman who trolled for salmon in 1972 but not in 1971.

exit salmon — fishermen who trolled for salmon in 1971 but not in 1972.

crab — fishermen who landed crab in 1972.

salmon and tuna — fishermen who fished for salmon and tuna in 1972.

salmon and/or tuna with crab — fishermen who fished for salmon and/or tuna, and for crab, in 1972.

drag — fishermen who fished for shrimp and/or bottom fish, and for crabs and/or tuna, in 1972.

Data were gathered by personal interview with randomly sampled skippers. The sample size for each type of fisherman is shown in Table 1. Questionnaires were administered after pretesting, and a total of 214 skippers were interviewed in the survey.

All data were for the period covering the 1972 season. It should be noted that economic performance of fishermen depends upon unit prices and total landings. The 1972 season appears to have been a fairly typical year with respect to price paid to fishermen for the major fish species (Table 2). Total landings were below average for crab and salmon, and above average for tuna and shrimp.

CHARACTERISTICS OF COMMERCIAL FISHERMEN

Specialized salmon fishermen (renewal salmon, entry salmon, and exit salmon) have less commercial fishing experience than do other types of fishermen (Table 3). However, they have more nonfishery employment experience than other types of fishermen.

Table 1.—Survey of Oregon's skippers[1].

Type of fishermen	Sample size	Estimated[2] population	Sample size (percent)
Fished in 1972			
Specialized[3]			
Renewal salmon	97	1,170-1,980	5-8
Entry salmon	16	130-220	7-12
Crab	11	35-60	18-31
Combination[4]			
Salmon-tuna	24	120-205	12-20
Salmon-tuna/crab	30	95-155	19-32
Drag (shrimp and/or bottomfish, with crab and/or tuna)	25	50-85	29-50
Subtotal for 1972	203	1,600-2,705	8-13
Fished in 1971 only			
Exit salmon	11	385-575	2-3
Total	214	1,985-3,280	7-11

[1]Excludes gillnetters, specialized tuna, clam diggers, shad, etc.
[2]The total number of skippers in each "type" is not known; thus, a range is given. The smaller numbers were derived from the sampling frame. The larger numbers reflect an upward adjustment of the sampling frame in order to reconcile the number of skippers with the number of commercial boat licenses issued by the Oregon Fish Commission. The latter figures were 3,487 in 1971 and 3,314 in 1972; these include an undetermined number of gillnet fishermen.
[3]Obtained at least 85 percent of the total value of their landings from a single fishery.
[4]Obtained at least 10 percent of the total value of their landings from each of two or more fisheries, with at least 85 percent from these two or more fisheries combined.

Table 2.—Ex-vessel price per pound and total landings of major fisheries in Oregon.

Item	Chinook salmon	Coho salmon	Crab	Shrimp	Tuna	Bottomfish
Ex-vessel price per pound ($)						
1969-73 weighted avg.	0.57	0.46	0.46	0.14	0.29	0.09
1972 season	0.57	0.50	0.42	0.14	0.31	0.09
Percent difference[1]	(0)	(+9)	(−9)	(0)	(+7)	(0)
Total landings (million pounds)						
1969-73 avg.	6.248	8.718	9.740	15.633	24.703	22.284
1972 season	5.085	6.483	6.762	20.731	29.234	22.801
Percent difference[1]	(−19)	(−26)	(−31)	(+33)	(+18)	(+2)

[1]1972 season relative to 1969-73 average.
Source: Data compiled by the Fish Commission of Oregon (now the Oregon Department of Fish and Wildlife).

Table 3.—Characteristics of Oregon skippers and their commercial fishing boats, 1972.

	Average for specialized fishermen				Average for combination fishermen		
Characteristics	Renewal salmon	Entry salmon	Exit salmon[1]	Crab	Salmon-tuna	Salmon-tuna/crab	Drag
Skippers							
Age	44	46	45	55	49	45	47
Formal education (years)	12	11	11	10	12	12	11
Nonfishery employment experience (years)	21	14	15	12	14	10	4
Miles from home town to port	27	28	45	0	15	0	0
Fishing experience (years)	8	2	10	24	16	18	22
Fishing Boats							
Age (years)	14	6	—[2]	22	26	24	29
Length (feet)	26	23	—	37	39	44	54
Beam (feet)	9	8	—	11	11	13	15
Horsepower	104	113	—	164	138	168	237
Total value of boat ($)	7,016	5,420	—	22,000	30,054	30,936	66,761
Number of crab pots	0	0	—	215	0	254	171
Number of men on the boat	1.5	1.5	—	2	2	3	3

[1]Data is from the 1971 fishing season.
[2]Not available.

The boat operated by the average salmon fisherman is between 23 and 26 feet in length, and is valued at between $5,000 and $7,000. In contrast, the average drag fishermen's boat has a market value of about $66,750. The market value of all other fishermen's boats is between $22,000 and $30,000.

Specialized salmon fishermen generally have a one- or two-man crew on their boats. Salmon-tuna fishermen generally employ one crew member; salmon-tuna/crab and drag fishermen usually employ two.

Specialized salmon fishermen spent about 32-40 days fishing and 8-19 days on maintenance and repair of boat and gear (Table 4). Their total days devoted to the fishery ranged from 45 to 55. Crab and salmon-tuna fishermen spend about 4 months in the fishery; tuna/crab and drag fishermen, approximately 7 months.

Approximately 85 percent of all specialized salmon skippers had nonfishery employment. For those who worked outside the fishery, total time spent in nonfishery employment was about 11 months. Thus, salmon fishing is usually done to supplement income from employment outside the fishing industry. Only 50 percent of the salmon-tuna fishermen have nonfishery employment, even though the length of their fishing season is only about 4 months.

Crab, salmon-tuna/crab, and drag fishermen spend the least time working outside the fishery. The 20 percent who do work outside the fishery spend, on the average, only 4-5 months at nonfishery jobs. Thus, in these three fisheries almost everyone is a full-time fisherman. These fishermen tend to live in coastal areas where nonfishery jobs are not always easy to find.

COSTS AND RETURNS IN COMMERCIAL FISHING

The gross returns are amounts received from the sale of fish landed during the survey year, regardless of where they were landed. The average gross returns of the seven types of fishermen varied considerably. Drag fishermen had considerably higher gross returns

per year ($73,808) than other types of fishermen (Table 5). Gross returns per fishing day were about $443 for drag fishermen and from $38 to $61 for salmon fishermen. Crab fishermen received about $312 gross returns per fishing day.

Production costs are categorized as variable or fixed. Variable costs comprise all cost items that are incurred only if the boat is actually used for fishing. Fixed costs include cost items that do not vary with fishing effort (annual depreciation, insurance, license fees, etc.). Depreciation was calculated on a straight-line basis using 18 years of remaining life and a zero salvage value for the boat. The average age of the larger boats is 22-29 years; this means that the expected life of a large boat is 40-47 years.

Variable costs for the average drag fishermen were about $36,000, compared with $1,000 to $1,600 for specialized salmon fishermen. Fixed costs were about $9,000 for drag fishermen and $600 for specialized salmon fishermen. Total production costs for drag fishing were about $45,000, some 20-30 times higher than total costs for specialized salmon fishermen, and twice as high as that for salmon-tuna/crab.

The ratios of gross return to total investment were relatively low for specialized salmon fishermen and salmon-tuna fishermen. The ratio of gross returns to total costs was the highest for salmon-tuna/crab fishermen, indicating high efficiency in their use of operating capital.

With regard to the efficiency of labor, the ratios of gross returns to numbers of men fishing indicated that specialized salmon fishermen produced very low returns to their labor input into the fishery. In addition, specialized salmon fishermen received low gross returns per day fished.

The average specialized salmon fisherman had total costs greater than gross returns, while the average crab and combination fishermen had gross returns greater than total costs. Gross returns less total costs were about −$60 to −$400 for the specialized salmon fishermen, $3,400 for the salmon-tuna fishermen, $8,600 for crab fishermen, $15,800 for salmon-tuna/crab fishermen, and $28,600 for drag fishermen.

This study assumes that opportunity cost of a skipper's investment in fishing

Table 4.—Characteristics of fishery and nonfishery employment by Oregon's commercial fishermen.

Characteristics	Average for specialized fishermen				Average for combination fishermen		
	Renewal salmon	Entry salmon	Exit salmon[1]	Crab	Salmon-tuna	Salmon-tuna/crab	Drag
Fishery employment							
Days spent fishing for							
Salmon	36	32	40	0	52	52	0
Crab	0	0	0	88	0	79	24
Tuna	0	0	0	0	33	27	1
Bottomfish	0	0	0	0	0	0	60
Shrimp	0	0	0	0	0	0	52
Total days fished	36	32	40	88	85	158	137
Days spent on maintenance and repair of boat and gear	19	14	8	34	34	47	50
Nonfishery employment							
Percent of skippers with nonfishery employment	84	94	82	18	50	23	20
Average length of nonfishery employment for all skippers (months)	9	10	10	2	4	1	1
Average length of nonfishery employment for those working outside the fishery (months)	11	11	12	7	8	4	5

[1]Data is from the 1971 fishing season.

Table 5.—Comparisons of costs, returns, and efficiency among Oregon commercial fishermen, 1972.

Financial and efficiency indicators	Average for specialized fishermen				Average for combination fishermen		
	Renewal salmon	Entry salmon	Exit salmon[1]	Crab	Salmon-tuna	Salmon-tuna/crab	Drag
Sample size	67	12	9	8	21	19	16
Investment ($)[2]	6,590	6,167	5,461	22,438	31,848	35,079	80,593
Costs and returns ($)							
Gross returns	2,215	1,229	1,154	25,721	11,369	36,807	73,808
Variable costs[3]	1,651	1,078	1,568	14,531	5,080	17,465	35,978
Fixed costs[4]	622	522	N/A	2,548	2,874	3,504	9,261
Gross returns less total costs	−58	−371	−414	8,642	3,415	15,838	28,569
Return to labor and management[5]	−652	−926	−905	6,623	549	12,681	21,316
Return to investment[6]	−945	−863	−876	−1,645	−1,133	1,115	−954
Efficiency ratios ($)[7]							
Gross return per dollar of total investment	0.40	0.20	0.40	1.20	0.40	1.10	1.00
Gross return per dollar of total cost	1.00	0.70	0.80	1.80	1.40	2.30	1.70
Gross return per man fishing	1,376	716	—	15,279	6,060	12,129	20,254
Gross return per day fished	61	38	45	312	133	234	443
Total cost per day fished	87	270	90	217	114	141	273

[1]1971 fishing season.
[2]Market value of the boat and gear.
[3]Costs that vary with fishing effort (fuel, boat repair, gear repair, crew's share, etc.)
[4]Costs that do not vary with fishing effort (insurance, license fees, association assessments, depreciation, etc.)
[5]Gross returns less total costs less opportunity cost of investment (9 percent of investment).
[6]Gross returns less total costs less opportunity cost of skipper's labor and management (40 percent of gross return).
[7]As an example of how these ratios were calculated, suppose that one fisherman's ratio of "gross return per day fished" was $250 per day. If a second fisherman's ratio was $200 per day, the average of the two would be $225 per day. (The ratios in the table cannot be derived from tables 3, 4, and 5 because of the mathematical nature of the ratio.)

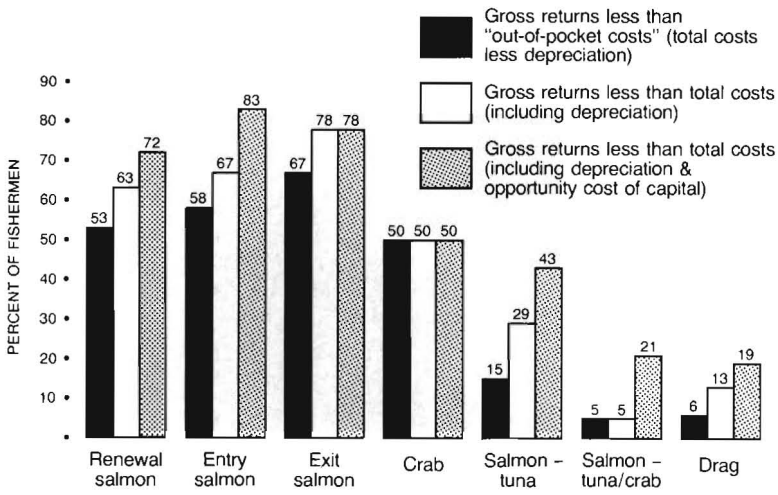

Figure 1.—Percent of fishermen incurring losses in 1972, by different definitions of "profit."

Table 6.—Production functions[1] and related statistics by type of fisherman in Oregon, 1972.

Item	Type of fisherman					
	Renewal salmon	Entry salmon	Crab	Salmon-tuna	Salmon-tuna/crab	Drag
Value of a (log form)	−0.477	−0.699	−7.027	−6.636	−1.426	1.142
Value of b_i:						
Boat capital (b_1)	0.322	0.382	1.164	0.319	0.531	0.491**
Operating capital (b_2)	0.181	0.251	−0.085	0.530*	0.573**	0.290
Fishing days (b_3)	0.885***	0.931***	1.337	0.223	0.237	0.360
Fishing experience (b_4)	0.311*	−0.444	−0.011	0.383*	−0.185	−0.132
t-value:						
Boat capital	1.663	1.528	0.404	1.612	1.377	2.818
Operating capital	0.760	0.579	−0.030	2.109	2.697	1.447
Fishing days	4.864	6.731	0.321	1.145	0.669	0.951
Fishing experience	1.786	−0.123	−0.009	1.815	−0.904	−0.648
R^2	0.52	0.99	0.61	0.88	0.64	0.77
Sample size	67	12	8	21	19	16

[1] $\log y = \log a + b_1 \log X_1 + b_2 \log X_2 + b_3 \log X_3 + b_4 \log X_4$.

***Significant at 1 percent probability level.
**Significant at 5 percent probability level.
*Significant at 10 percent probability level.

gear and vessel is 9 percent of the market value of the investment. This percentage was chosen because AAA-rated bonds are paying over 9 percent interest; if a fisherman sold his boat at its market value and invested the money elsewhere, he could expect at least a 9 percent return on his investment. When this opportunity cost is deducted from gross returns less total costs, the remainder is the return to the skipper's labor and management. The average return to labor and management was from −$652 to −926 for specialized salmon fishermen, $549 for salmon-tuna fishermen, $6,623 for crab fishermen, $12,681 for salmon-tuna/crab fishermen, and $21,316 for drag fishermen.

The percentages of fishermen who sustained losses in fishing are shown in Figure 1. Among the renewal salmon fishermen, for example, 53 percent had gross returns which were less than "out-of-pocket" costs (i.e., total costs less depreciation). This group clearly had unprofitable operations in 1972. When a stricter definition of "profit" is applied (to include depreciation as a cost), 63 percent of the renewal salmon fishermen had unprofitable operations. The difference between the 53 and 63 percent figures is the 10 percent who had gross returns sufficient to cover "out-of-pocket" costs but not depreciation. When the definition of profit includes the opportunity cost of capital, 72 percent had unprofitable operations and only 28 percent could show a profit.

In contrast to specialized salmon fishermen, half or more of the fishermen in the other types of fishing had business enterprises which were clearly profitable in 1972. The highest percentages of profitable enterprises were among drag fishermen (81 percent) and salmon-tuna/crab fishermen (79 percent).

PRODUCTION FUNCTIONS OF COMMERCIAL FISHERIES

This section deals with the estimation of production functions. The production function is a relationship between output (gross returns) and resources. The following production function was employed:

$\log y = \log a + b_1 \log x_1 + b_2 \log x_2 + b_3 \log x_3 + b_4 \log x_4$

where y = gross returns in dollars
x_1 = boat capital in dollars (i.e., market value of boat and gear)
x_2 = operating capital in dollars
x_3 = fishing days, and
x_4 = commercial fishing experience in years (a proxy for management input).

The estimation of the parameters of the production function was accomplished by the least-squares regression method. The elasticities of production, b_i (regression coefficient), indicate the percentage by which returns would increase with a 1 percent increase in use of a particular resource. As an illustration, column two of Table 6 indicates that the elasticity of production with respect to fishing days was 0.885 for renewal salmon fishermen. A 1 percent increase in fishing days would bring about an increase of 0.885 percent in gross returns of renewal fishermen if other inputs are held constant. Similarly, an increase in fishing years by 1 percent would lead to an increase in gross returns of renewal salmon fishermen by 0.311 percent. Thus, the most important explanatory variable for renewal salmon fishermen's gross re-

turns was fishing days. The same can be said for entry salmon fishermen.

Operating capital made the most significant contribution to the determination of gross returns for salmon-tuna and salmon-tuna/crab fishermen, while boat capital made the most significant contribution to draggers' gross returns. Interestingly, regression coefficients for boat capital were only statistically significant in the drag fishermen's equation. This suggests that trawler operations at larger scale levels may be more productive.

TOTAL INCOMES OF COMMERCIAL FISHERMEN

Some commercial fishermen have two sources of income: fishery and nonfishery. Nonfishery income includes money received by the skipper and other family members for working outside the fishery, e.g., Social Security payments, interest, rent, etc. Net fishery income is measured as gross returns less total costs (including depreciation) of the fishing business. This is the amount available for the fisherman's living expenditure and investment in his fishery. This net fishery income was added to nonfishery income to obtain total family income.

The average net fishery income of five types of fishermen without nonfishery employment were much higher than that of four types of fishermen with nonfishery employment. Table 7 also indicates that full-time skippers had higher total costs and gross returns than those of part-time skippers. Thus, the high net fishery income of full-time fishermen was due to their high capital investment and large catches.

Renewal salmon fishermen with nonfishery employment reported the highest nonfishery income, averaging $11,639 per family. About 70 percent of this amount came from the skipper's employment outside the fishery. Most of the full-time fishermen received less than $3,000 in nonfishery income. The families of those crab fishermen who did not work outside the fishery, however, averaged over $11,000 from nonfishery income, primarily due to other family member's labor incomes.

Table 7.—Average income of Oregon's commercial fishermen, 1972.

Item	Fishermen without nonfishery employment				
	Renewal salmon	Crab	Salmon-tuna	Salmon-tuna/crab	Drag
Sample size	8	6	10	14	15
Fishery income ($):					
Gross returns	3,848	33,376	15,505	39,830	73,641
Total costs	3,200	21,542	8,733	25,947	45,507
Net fishery income	648	11,834	6,772	13,883	28,134
Nonfishery income ($):					
Skipper's labor income	0	0	0	0	0
Other family members' labor income	463	9,077	1,148	2,894	2,229
Other nonfishery income[1]	4,608	2,418	1,286	302	668
Total nonfishery income	5,071	11,495	2,434	3,196	2,897
Total family income[2]	5,719	23,329	9,206	17,079	31,031

	Fishermen with nonfishery employment			
	Renewal salmon	Entry salmon	Exit[3] salmon	Salmon-tuna
Sample size	59	11	8	11
Fishery income ($):				
Gross returns	1,994	1,322	0	7,609
Total costs	2,149	1,611	0	7,246
Net fishery income	−155	−289	0	363
Nonfishery income ($):				
Skipper's labor income	7,981	9,736	8,344	6,270
Other family members' labor income	2,737	380	1,203	2,261
Other nonfishery income[1]	921			2,176
Total nonfishery income	11,639	10,116	9,547	10,707
Total family income[2]	11,484	9,827	9,547	11,070

[1]Includes Social Security payments, unemployment compensation, interest, dividends, rent, etc.
[2]Total family income = net fishery income plus total nonfishery income.
[3]Income for 1971.

The average family incomes of nine types of fishermen differed considerably. Those renewal salmon fishermen who did not work outside the fishery had the lowest total family income ($5,719); their major sources of income included Social Security and other retirement income. Drag fishermen had the highest total family income ($31,031); a major contributing factor was fishing success.

The fishermen who had some nonfishery employment had an average total family income of $9,500 to $11,500. This corresponds very closely to the average U.S. household income of $11,282 in 1972. Those fishermen who did not report employment outside the fishery had a considerably higher average income than the national average, with the exception of the renewal-salmon and salmon-tuna fishermen.

SUMMARY AND CONCLUSIONS

Specialized salmon fishermen spent less days in commercial fishing than did other types of fishermen. The average number of fishing days for specialized salmon fishermen was between 32 and 40; the average number for crab and combination fishermen ranged from 85 to 148 days. For salmon boats the number of fishing days is the most significant determinant of annual gross returns.

Approximately 63 and 67 percent of renewal salmon and entry salmon fishermen, respectively, had gross returns that were less than total costs. However, only 5 percent of the salmon-tuna/crab fishermen had total costs which exceeded gross returns and about 13 percent of drag fishermen had unprofitable enterprises.

About 85 percent of specialized

salmon fishermen had nonfishery employment in 1972, while only about 20 percent of the crab, drag, and salmon-tuna/crab fishermen worked outside the fishery in addition to fishing. It is apparent that most of the specialized salmon fishermen engaged in commercial fishing on a part-time basis and made most of their income from nonfishery employment.

Drag fishermen received the highest average family income of $31,031. The production function analysis indicated that investment in a large trawler is profitable assuming the environment existing in 1972.

It has to be emphasized that our analysis in this paper is based on 1972 prices and landings in Oregon. In order to make a more meaningful inference on profitability of commercial fishermen over time, it would be necessary to extend our calculations for different seasons.

It is believed that socioeconomic characteristics for the segments sampled are reasonably representative of the industry as a whole. Since most of Oregon's commercial fishermen had nonfishery employment in addition to commercial fishing, development of a fishery management program should consider its potential socioeconomic impact on fishing and nonfishing sectors.

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