

ALASKA LEGISLATURE SPECIAL COMMITTEE / SUBJECT FILES 86/2

576 SCOM117: JOINT INTERIM COMM. ON LIMITED ENTRY 1979

In most cases there was a gradual increase in price up to 1973, a big jump that year, and then a leveling off, or slight decline in the following years. The exception was the price of king salmon, which, except for slight drops in 1970 and 1975, showed constant increases in price, with a dramatic increase in 1976.

Table 7 - Prices in dollars per pound in the round to the fishermen for drift gillnet caught salmon in the Prince William Sound, Copper and Bering River areas from 1969 to 1976, adjusted into constant 1976 dollars using the wholesale price index for all commodities.

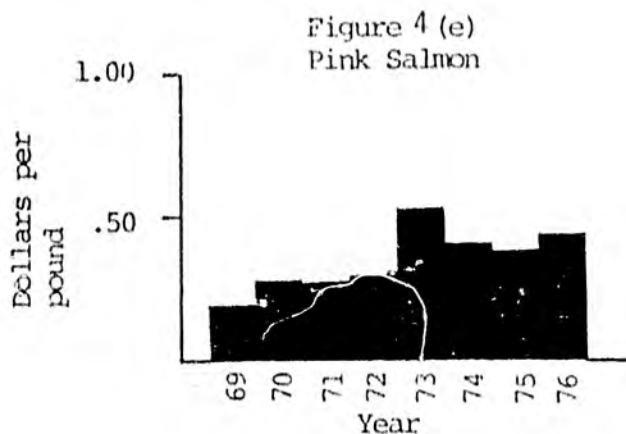
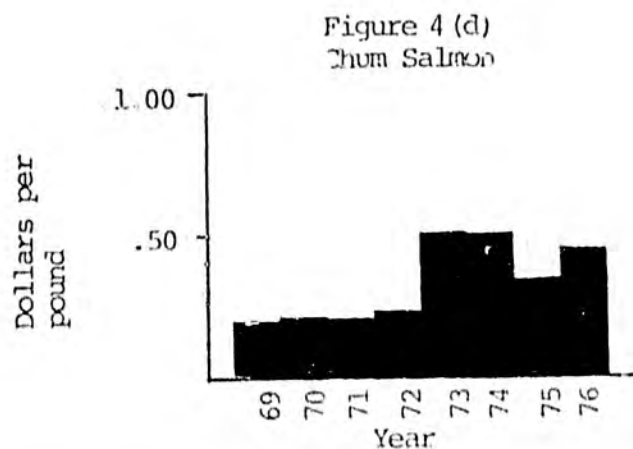
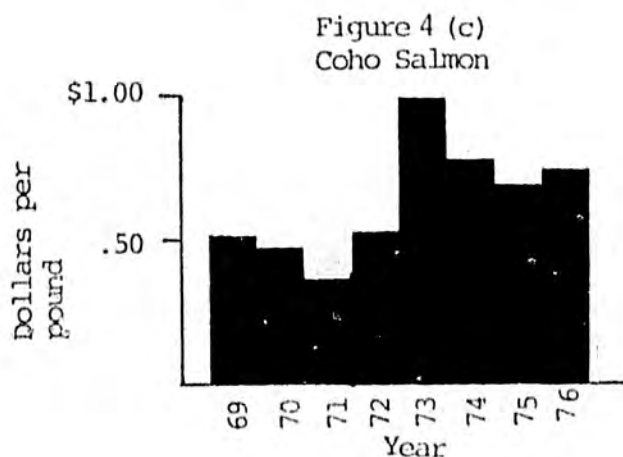
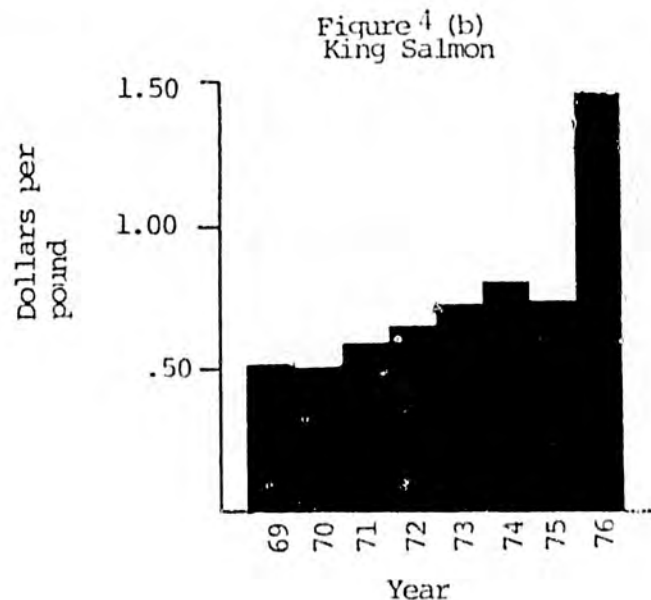
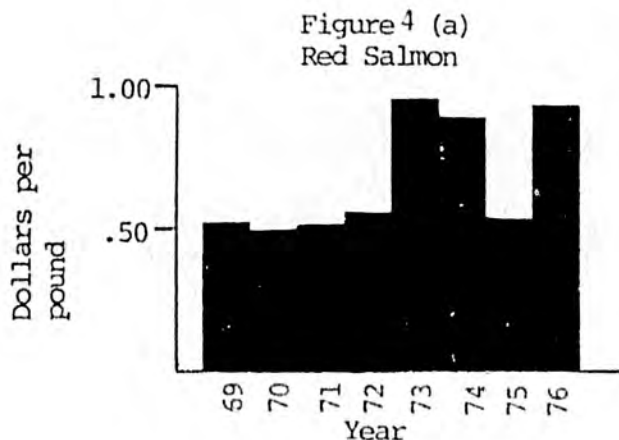
Year	King	Red	Coho	Pink	Chum
69	.515	.515	.515	.206	.189
70	.497	.497	.497	.265	.215
71	.578	.514	.361	.257	.209
72	.637	.561	.522	.284	.238
73	.713	.944	.985	.509	.496
74	.817	.862	.759	.411	.497
75	.727	.528	.675	.371	.329
76	1.465	.915	.715	.415	.450

Source: Table 6; United States Department of Labor wholesale price index for all commodities, 1967=100.

The price increases over the past eight years were not unique to the Prince William Sound salmon drift gillnet fishery, but occurred in other salmon producing areas of the state as well. Prices in Bristol Bay and Cook Inlet for drift gillnet caught salmon also show the same general upward trend, with a decline in 1975, and a rebound in 1976.^{3/}

3/ Based on price estimates for Cook Inlet and Bristol Bay made by CFEC staff.

Figure 4 - Prices in dollars per pound in the round to the fishermen for drift gillnet caught salmon in the Prince William Sound, Copper and Bering River areas from 1969 to 1976, adjusted into constant 1976 dollars using the wholesale price index for all commodities.



Source: Table 7; United States Department of Labor Wholesale Price Index for all commodities, 1967=100.

CATCH BY SPECIES IN POUNDS, 1969-1977^{4/}

The information in the following tables is based on catch data from fish tickets, summarized in computer printouts from the Alaska Department of Fish and Game. Table 8 shows the monthly distribution for each of the five species of salmon for an 8 year period while Table 9 and Figure 5 (a-e), show the catch patterns and trends clearly. The catch of king salmon ranged between 390,000 and 682,000 pounds, except for a jump to 903,000 pounds in 1976. The red salmon catch ranged between 3,300,000 pounds in 1973 and 7,000,000 pounds in 1970. The coho salmon catch fluctuated severely but seems to be at lower levels in recent years. The average catch in the first four years was 1,721,000 pounds while that for the second four was 1,216,000. Both pink and chum salmon catches increased substantially during the 8 year period, partly because of additions to the gillnet area and season in the Coghill district.

^{4/} Preliminary figures for 1977.

Table 8

MONTHLY DISTRIBUTION OF TOTAL POUNDS BY EACH SPECIES OF
SALMON HARVESTED BY THE DRIFT GILNET FLEET
IN THE PRINCE WILLIAM SOUND AREA
1969-1977*

KING SALMON

<u>Year</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>August</u>	<u>September</u>
1969	163,229	223,194	3,365	16	30
1970	300,578	286,665	2,846	293	129
1971	5,503	439,651	3,043	113	15
1972	159,368	511,933	3,201	131	-
1973	263,490	414,415	3,964	162	-
1974	265,760	366,340	5,263	50	-
1975	185,758	363,824	9,000	254	-
1976	438,966	458,624	5,396	395	80
1977*	422,195	209,389	2,131	394	-

RED SALMON

<u>Year</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>August</u>	<u>September</u>
1969	1,106,418	3,254,057	700,171	38,640	-
1970	2,926,775	3,456,770	597,500	27,629	1,300
1971	128,685	3,434,738	894,525	50,184	12
1972	1,707,098	2,643,029	1,534,690	67,686	-
1973	675,238	1,871,699	715,523	11,506	-
1974	1,271,010	2,949,804	828,809	13,995	-
1975	948,386	1,930,076	758,510	3,005	-
1976	3,172,753	2,543,729	900,433	37,029	266
1977*	2,552,597	2,545,050	979,366	26,568	279

COHO SALMON

<u>Year</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>August</u>	<u>September</u>
1969	315	3,135	272	149,670	604,254
1970	-	2,559	5,279	1,011,311	1,287,218
1971	-	582	12,281	745,235	2,015,565
1972	75	343	29,110	563,586	452,202
1973	-	2,319	8,305	1,084,455	757,518
1974	10	290	12,093	15,969	662,235
1975	1,935	146	3,600	341,020	387,363
1976	-	39	5,417	914,567	668,641
1977*	-	213	8,803	1,148,251	753,531

PINK SALMON

<u>Year</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>August</u>	<u>September</u>
1969	-	970	12,716	11,131	653
1970	-	15,949	66,157	11,679	16
1971	-	285	18,087	6,461	-
1972	1,953	89,309	48,181	12	-
1973	-	10,455	446,578	28,789	-
1974	15	67,299	1,546,532	6,251	-
1975	-	10,910	775,980	60,295	-
1976	-	36,338	709,133	9,246	123
1977*	4	333,048	2,009,518	109,200	88

CHUM SALMON

<u>Year</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>August</u>	<u>September</u>
1969	-	40,437	49,475	3,012	22
1970	24	29,823	37,954	2,191	6
1971	69,632	37,763	1,748	-	-
1972	61,615	199,626	54,600	30	-
1973	5,408	303,317	668,470	17,596	-
1974	535	179,803	509,155	333	-
1975	28	75,447	223,390	10,142	-
1976	9	379,852	641,157	27	-
1977*	617	469,272	758,805	15,034	25

* Preliminary figures

Source: Alaska Department of Fish and Game dated January 14, 1978.
(Hereafter called ADFG-78) for 1977 Preliminary Figures
CFEC "Catch Tabulation from Gross Earnings, dated December, 1978.

TABLE 9

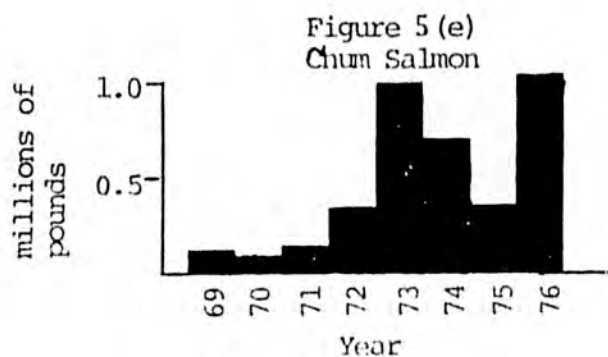
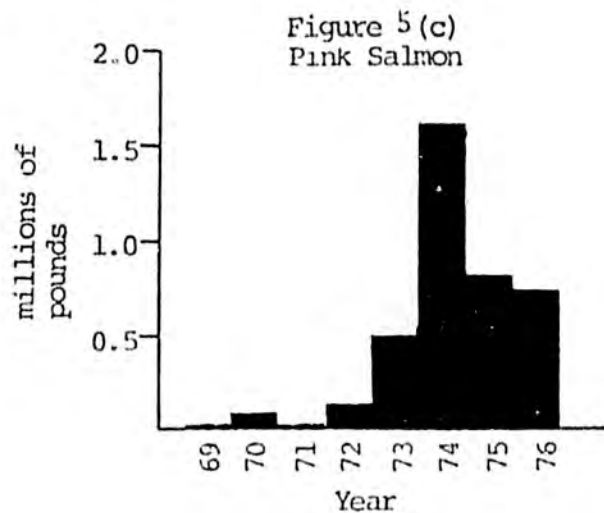
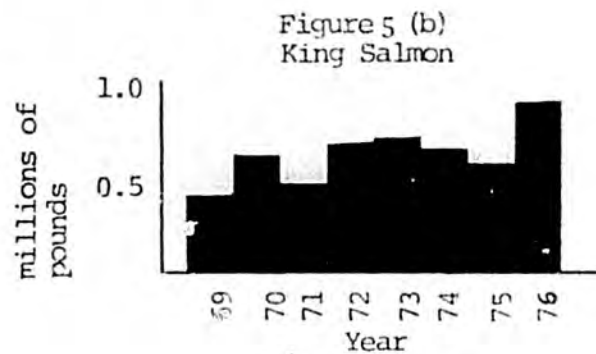
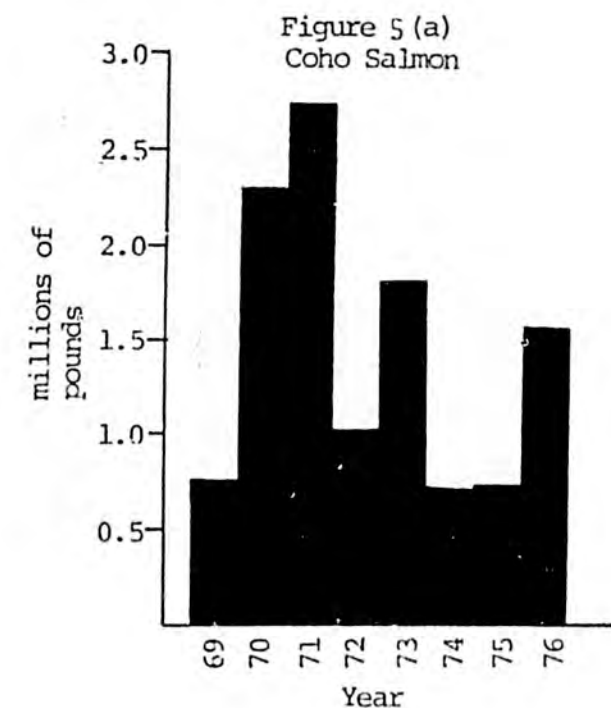
TOTAL CATCH IN POUNDS BY YEAR FOR EACH SPECIES OF
SALMON HARVESTED WITH DRIFT GILL-NET GEAR IN THE
PRINCE WILLIAM SOUND MANAGEMENT AREA 1969-1977

<u>Year</u>	<u>King</u>	<u>Red</u>	<u>Coho</u>	<u>Pink</u>	<u>Chum</u>
1969	390,023	5,101,937	757,646	25,470	92,946
1970	591,197	7,018,077	2,306,367	93,801	69,998
1971	448,325	4,508,144	2,773,663	24,833	109,143
1972	674,633	5,953,303	1,045,316	139,455	315,871
1973	682,031	3,273,966	1,852,597	485,822	994,791
1974	637,413	5,063,618	690,597	1,620,097	689,826
1975	558,836	3,639,977	734,072	847,185	309,007
1976	903,461	6,654,210	1,588,686	754,840	1,021,045
1977*	634,109	6,103,860	1,910,802	2,451,858	1,263,753

*Preliminary figures.

Source: Table 8 (Table 9 includes catch in pounds for the months not shown in Table 8.)

Figure 5 - Total catch of salmon in pounds with drift gillnet gear in the Prince William Sound Management area, by species and by year, 1969 to 1976.



Source: ADFG-78

APPENDIX

METHOD OF PRICE ADJUSTMENT

The prices received by the fishermen in any particular year (these are given in Table 6) were inflated by a factor designed to express them in 1976 dollars. The "inflation factor" for each year was obtained using the U.S. Department of Labor's Wholesale price index for all commodities. The index for the year whose price it was desired to inflate was subtracted from the index for 1976. The percentage increase in the index was then determined and the price was inflated by that percentage.

The multiplier for 1969 was calculated by finding that the difference between the indices 1969=106.5 and 1976=182.9 was 76.4. The difference meant a 71.74% increase in the index between 1969 and 1976. The multiplier for 1969 was therefore 1.717. The king salmon price received by the fishermen in 1969 was .30, the inflated price was $(1.717)(.30)$ or .515.

The following table shows the work involved in calculating the inflation factors.

Inflation factor calculations				
Year _i	WPI _i *	WPI ₇₆ - WPI _i	% change in WPI between year _i and 1976	Inflation multiplier for year _i
69	106.5	76.4	71.74	1.717
70	110.4	72.5	65.67	1.657
71	113.9	69	60.58	1.606
72	119.1	63.8	53.57	1.536
73	134.7	48.2	35.78	1.358
74	160.1	22.8	14.24	1.142
75	174.9	8	4.57	1.046
76	182.9	0	0	0

*for all commodities, 1967=100.

Source: U.S. Department of Labor.

TABLE A-1

SUMMARY OF AVERAGE COSTS (Excluding Opportunity Costs) FOR DRIFT GILLNET
FISHING FOR SALMON IN THE PRINCE WILLIAM, COPPER RIVER AND BERING RIVER
AREAS IN 1976.

Cost Category	Averages for the Sampled Fleet			(D) Total Fleet (476) Weighted Sum
	(A) Total Sampled Vessels	(B) Grossed \$20,000 and Over	(C) Grossed Under \$20,000	
1. Insurance	\$ 311 (76)	\$ 362 (37)	\$ 263 (39)	\$ 312
2. Dues	109 (80)	111 (40)	58 (40)	80
3. Moorage	153 (80)	179 (40)	127 (40)	149
4. Administration	204 (73)	260 (36)	149 (37)	194
5. Vessel Repairs	936 (75)	842 (38)	1,033 (37)	955
6. Depreciation	820 (52)	1,017 (28)	591 (24)	768
7. License Fees	91 (83)	97 (41)	86 (42)	90
8. Fuel	849 (75)	1,013 (40)	660 (35)	806
9. Galley Expenses	847 (76)	907 (39)	784 (37)	835
10. Gillnetting Equip- ment Repairs	1,380 (27)	1,436 (12)	1,337 (15)	1,380
11. Travel & Freight	511 (76)	638 (38)	389 (38)	492
12. Special Clothes	179 (78)	169 (39)	189 (39)	181
13. Fish Assessments	66 (81)	98 (40)	35 (41)	62
14. Crewshare	512 (83)	589 (41)	437 (42)	501
15. Interest payments	339 (74)	369 (35)	313 (39)	337
16. TOTAL COSTS	\$7,307	\$8,087	\$6,451	\$7,143
17. AVERAGE GROSS EARNINGS	\$21,151 (83)	\$32,465 (41)	\$10,106 (42)	\$19,582 (476)
18. NET RETURN TO LABOR AND MANAGEMENT	\$13,844	\$24,378	\$ 3,655	\$12,439

Source: 1977 Prince William Sound Drift Gillnet Operating Cost Survey conducted by Commercial Fisheries Entry Commission; CFEC Vessel Data Multiple Listing computer generated file for 1976, prepared November 12, 1977; Table 3.

TABLE A-2

SUMMARY OF AVERAGE COSTS (Including Interest) FOR DRIFT GILLNET FISHING
FOR SALMON IN THE PRINCE WILLIAM SOUND, COPPER
RIVER AND BERING RIVER AREAS IN 1976.

Cost Category	Averages for the Sampled Fleet			(D) Total Fleet (476) Weighted Sum
	(A) Total Sampled Vessels	(B) Grossed \$20,000 and Over	(C) Grossed Under \$20,000	
1. Insurance	\$ 311 (76)	\$ 362 (37)	\$ 263 (39)	\$ 312
2. Dues	109 (80)	111 (40)	58 (40)	80
3. Moorage	153 (80)	179 (40)	127 (40)	149
4. Administration	204 (73)	260 (36)	149 (37)	195
5. Vessel Repairs	936 (75)	842 (38)	1,033 (37)	955
6. Depreciation	820 (52)	1,017 (28)	591 (24)	768
7. License Fees	91 (83)	97 (41)	86 (42)	90
8. Fuel	849 (75)	1,013 (40)	660 (35)	806
9. Galley Expenses	847 (76)	907 (39)	784 (37)	835
10. Gillnetting Equip- ment Repairs	1,380 (27)	1,436 (12)	1,337 (15)	1,380
11. Travel and Freight	511 (76)	638 (38)	389 (38)	492
12. Special Clothes	179 (78)	169 (39)	189 (39)	181
13. Fish Assessments	66 (81)	98 (40)	35 (41)	62
14. Crewshare	512 (83)	589 (41)	437 (42)	501
15. Interest payments	339 (74)	369 (35)	313 (39)	337
16. Opportunity Cost of Investment	1,948 (50)	2,351 (27)	1,476 (23)	1,839
17. Opportunity Cost of Holding an Entry Permit	529	529	529	529
18. TOTAL COSTS	\$9,784	\$10,967	\$8,456	\$9,511
19. AVERAGE GROSS EARNINGS	\$21,151 (83)	\$32,465 (41)	\$10,106 (42)	\$19,582 (476)
20. NET RETURN TO LABOR AND MANAGEMENT	\$11,367	\$21,498	\$ 1,650	\$10,071

Source: 1977 Prince William Sound Drift Gillnet Operating Cost Survey conducted by Commercial Fisheries Entry Commission; CFEC Vessel Data Multiple Listing computer generated file for 1976, prepared November 12, 1977; Table 3.

SUMMARY OF COST AND NET RETURN INFORMATION
FOR THE BRISTOL BAY DRIFT GILL-NET FISHERY

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February, 1979

INTRODUCTION

The following tables and figures present the results of a survey designed to obtain information on the operating costs of fishermen in the Bristol Bay drift gill-net fishery in 1976, and summarize fishing gross earnings, price and catch information for that fishery from 1969 to 1976. Estimates of catch size were made from fish tickets, and prices were derived from processor's annual reports and estimates by the Commercial Fisheries Entry Commission (CFEC). The operating cost survey was carried out by mail in the late summer and fall of 1977. Two-hundred and forty-three fishermen, or 18% of the 1,370 fishermen who used their permanent or interim-use permits in the Bristol Bay drift gill-net fishery in 1976 provided completed questionnaires. Using this information, average net returns in 1976 were estimated for the total sample fleet as well as for members of the sample falling into four graduated increments of gross earnings. The cost and net return information for the sample fleet is also presented for Bristol Bay residents and non-residents. A pair of tables summarizes the average prices for entry permits from 1975 to the first part of 1978, and outlines the status of permanent and interim-use permits through 1977.

This paper has been prepared to report the survey results to fishermen who responded to the operating cost survey mentioned above. We hope it will be useful to them. The Commission will appreciate any comments or suggestions on the data or on the method of presentation.

OPERATING COSTS

The cost information summarized in Tables 1 and 2 was obtained in the late summer and fall of 1977 with a survey of the drift gill-net fishermen operating in the Bristol Bay area.

Column A of Table 1 lists the average cost in each category for all of the boats sampled (243); the number of responses on which each average is based is listed in parentheses. Columns B-E of Table 1 give the average of the survey responses for all the respondents who grossed \$30,000 or over; \$20,000-29,999; \$10,000-19,999; and under \$10,000, respectively. The cost information summarized in Table 2 lists the average for each cost category for fishermen who were residents of Bristol Bay area and for fishermen who were not residents of the Bristol Bay area in 1976. A comparison of Figure 1 and 2 immediately following the notes to Table 1 and 2 shows 77% of the total Bristol Bay drift gill-net fleet grossed under \$20,000 (figure 1), while 74% of the sampled fleet grossed under \$20,000 (figure 2). This indicates that the sampled drift gillnet fleet is representative of the total fleet with respect to fishing gross earnings of under \$20,000 and over \$20,000. When reviewing the working draft of this report, Mr. Andrew Golia from the Bristol Bay Native Association mentioned that we may not be representative in the lower fishing gross earning increment for the sample fleet due to the fact that questionnaires may have been disregarded, if the fishermen could not understand or read the questions. Many of these fishermen are Yup'ik Eskimo people. This may be the reason the total fleet (figure 1) shows 17.5% of the fishermen made under \$5,000, while the sample fleet shows only 6.6% of the fishermen made under \$5,000 from their drift gill-netting in the Bristol Bay area. Also it was found that the average horsepower for the sample and total Bristol Bay drift gill-net fleet is 141.5 and 155.5, respectively.

In a real sense, the cost of any action is the opportunities for other actions that are given up. The cost of gas or a new leadline is the opportunity of doing something else with the money: buying a new hunting rifle, going to a good restaurant for dinner, or purchasing new buoys for crab pots. In this respect so-called "opportunity costs" are costs like any other, a lost opportunity. Those interested in the amount of "ready cash" available to the average fishermen at the end of the season should use Table A-1 found in the Appendix to this report. Table A-1 does not include any opportunity costs.

Insurance costs and the costs for dues, moorage, administration, vessel repairs, rental/leasing, and depreciation obtained in response to questions on the survey were assumed to be for the operation of the vessel in all of its fisheries. The average fisherman sampled earned 98% of his gross fishing income from salmon drift gill-netting, therefore these costs were prorated according to the proportion of gross earnings that each fishing vessel derived from drift gill-net salmon fishing to determine what part of these costs should be assigned to the drift gill-netting activities. When the respondents to the survey noted that certain costs were shared by their crew, these were deducted in the cost categories.

Please note that interest payments have not been included in Table 1 and 2. The objective of this report is to provide operating cost information to the fishermen so that they may compare their performance with that of others in the fishery. Interest payments vary widely reflecting the unique financial position of each individual fisherman. Therefore to attain comparability of the costs of actual fishing operations, interest is not included as a cost category.

If the purpose of this report was strictly to determine the average net returns to the fishing business including relevant opportunity costs and interest payments, please refer to Table A-2 found in the Appendix to this report.

The notes following Table 2 are essential to an interpretation of the categories and estimates contained in Tables 1 and 2. The average net return may be underestimated due to the reasons mentioned in paragraph 18 and 19 in the notes.

TABLE 1*

SUMMARY OF AVERAGE COSTS FOR DRIFT GILL-NET FISHING
FOR SALMON IN THE BRISTOL BAY AREA IN 1976.

Cost Category	Averages for the Sampled Fleet				
	(A) Total Vessels	(B) Grossed \$30,000 and Over	(C) Grossed \$20,000-29,000	(D) Grossed \$10,000-19,999	(E) Grossed Under \$10,000
1. Insurance	\$ 225 (201)	\$ 467 (7)	\$ 348 (46)	\$ 206 (88)	\$ 132 (60)
2. Dues	78 (218)	102 (9)	78 (47)	78 (96)	75 (66)
3. Moorage & Storage	48 (178)	40 (6)	50 (38)	68 (72)	24 (62)
4. Administration	253 (199)	339 (7)	396 (40)	246 (90)	160 (62)
5. Vessel Repairs	774 (221)	899 (9)	940 (50)	809 (94)	588 (68)
6. Depreciation	626 (229)	772 (10)	938 (49)	657 (97)	355 (73)
7. License Fees	107 (243)	109 (10)	105 (53)	108 (104)	106 (76)
8. Fuel	295 (231)	423 (10)	418 (52)	276 (99)	213 (70)
9. Galley Expenses	274 (208)	474 (8)	357 (43)	272 (90)	200 (67)
10. Gillnetting Equip- ment Repairs	509 (162)	1,198 (7)	610 (36)	477 (67)	478 (52)
11. Borough Fish Tax	247 (137)	342 (6)	327 (26)	280 (58)	154 (47)
12. Travel & Freight	448 (210)	409 (8)	647 (44)	410 (88)	376 (70)
13. Special Clothes	123 (221)	123 (9)	148 (49)	127 (95)	115 (68)
14. Rental & Leasing	484 (151)	223 (7)	650 (34)	622 (56)	271 (54)
15. Crewshare	4,804 (238)	8,579 (10)	8,462 (53)	4,498 (101)	2,091 (74)
16. Opportunity Cost of Investment	1,372 (219)	1,754 (9)	1,979 (49)	1,411 (91)	847 (70)
17. Opportunity Cost of Holding a Permit	304	304	304	304	304
18. TOTAL COSTS	\$10,971	\$16,557	\$16,757	\$10,849	\$ 6,489
19. Average Gross Earnings	\$15,143 (243)	\$36,245 (10)	\$24,031 (53)	\$14,459 (104)	\$ 6,817 (76)
20. NET RETURN TO LABOR AND MANAGEMENT	\$ 4,172	\$19,688	\$ 7,274	\$ 3,610	\$ 328

*Does not include Interest payments.

Source: 1977 Bristol Bay Drift Gill-net Operating Cost Survey, conducted by Commercial Fisheries Entry Commission; CFEC 1976 Gross Earnings by ADF&G by specific salmon species dated 12/78; Table 4.

TABLE 2*

SUMMARY OF AVERAGE COSTS AND NET RETURNS
FOR THE BRISTOL BAY AREA DRIFT GILL-NET
FISHERY BY RESIDENT OR NON-RESIDENT
OF BRISTOL BAY IN 1976.

	Averages for the Sampled Fleet	
	Resident of Bristol Bay	Non-Resident of Bristol Bay
1. Insurance	\$ 170 (77)	\$ 259 (124)
2. Dues	53 (82)	93 (136)
3. Moorage	50 (72)	47 (106)
4. Administration	187 (75)	292 (124)
5. Vessel Repairs	954 (85)	662 (136)
6. Depreciation	567 (86)	661 (143)
7. License Fees	66 (94)	134 (149)
8. Fuel	380 (89)	242 (142)
9. Galley Expenses	335 (76)	239 (132)
10. Gillnetting Equip- ment Repairs	510 (62)	503 (101)
11. Borough Fish Tax	102 (54)	334 (83)
12. Travel & Freight	294 (68)	523 (142)
13. Special Clothes	133 (83)	121 (138)
14. Rental & Leasing	282 (60)	618 (91)
15. Crewshare	4,815 (92)	4,790 (146)
16. Opportunity Cost of Investment	1,228 (84)	1,461 (135)
17. Opportunity Cost of Holding an Entry Permit	304	304
18. TOTAL COSTS	\$10,430	\$11,283
19. Average Gross Earnings	\$15,622 (94)	\$14,841 (149)
20. NET RETURN TO LABOR AND MANAGEMENT	\$ 5,192	\$ 3,558

* Excludes interest payments. The average interest payments for the residents and non-residents of the sampled Bristol Bay drift gill net fleet are \$109 and \$144 respectively.

Source: CFEC Alpha List dated 2/1/78; CFEC 1977 Bristol Bay Drift Gill Net Operating Cost Survey, and CFEC 1976 Gross Earnings by ADF&G by specific salmon species dated 12/3/78.

INFORMATION ON THE DIFFERENT COST CATEGORIES USED IN TABLES 1 AND 2.

1. This cost category consists of insurance payments
2. This cost category consists of union and association dues.
3. This category includes moorage and storage charges and moorage related utility charges.
4. Administrative costs include costs such as telephone, legal services, bookkeeping, bank charges, and property taxes, but did not include interest charges and repayments on loans for purchase of the vessel or gear. One of the interviewers working for the Entry Commission on this survey in the Prince William Sound area reported that the fishermen being interviewed there sometimes had trouble thinking of the type of costs that went to make up this category, and questions from the interviewer were necessary to obtain the information. In a mail survey this prompting would have been unavailable, and the administrative costs might have been underestimated.
5. This category includes vessel and engine repairs, and repairs to gear such as anchors, lines and electronics. It was found from 220 questionnaires with responses that 14 years was the average age of the vessel used by these fishermen.
6. Depreciation was based on the vessels' market value and was calculated using the straight line method over 15 years, assuming that the vessel would have no resale value. The depreciation was calculated for the vessel, which is a long-lived asset, but not for the drift gill-net fishing gear. If it was noted on the survey response that the vessel was owned by a processor/cannery, a zero value was used for the depreciation cost of that vessel. Based on 202 questionnaires with responses, it was found that the average 1976 market value of the vessel for the five gross earning increment groups (columns A-E) shown in Table 1 was: \$10,535; \$13,661; \$10,591, and \$6,438 respectively.
7. This cost was not taken from the survey responses, but was estimated for each fisherman on the assumption that one vessel license, one gear license, one commercial license and one entry permit would be required for the operation of each vessel. The vessel and commercial license costs were prorated among the various fisheries in which the vessel was operated. Distinctions were made between the costs for resident and non-resident licenses and between permit fees for poverty level and non-poverty level permit holders. It was assumed that the cost of commercial and gear licenses for crewmembers were borne by the crewmembers themselves and did not enter into the costs of the vessel operator. The cost of an entry permit was assumed to be its renewal fee.

INFORMATION ON THE DIFFERENT COST CATEGORIES USED IN TABLES 1 AND 2 (CONT.)

8. This category includes the costs of fuel and engine lubricants.
9. This category includes the galley expenses.
10. This category includes the costs involved in purchase of and repairs to drift gill-net gear. Based on 200 questionnaires with responses, it was found that the average market value of drift gill-net gear for the five gross earning increment groups (column A-E) shown in Table 1 was \$2,411; \$3,367; \$3,085; \$2,226, and \$1,603 respectively. Also from the 200 respondents grouped by resident or non-resident of Bristol Bay, (Table 2) the average market value of drift gill-net gear was \$2,231 and \$2,393 respectively.
11. This category includes the borough fish tax assessment taken from the survey response.
12. This category includes the costs of travel and freight.
13. This category includes the costs of special items of clothing.
14. This category includes the costs of renting or leasing the vessel or gear. It was found from 243 questionnaires with responses that 11% were vessels owned by processors.
15. This category consists of payments to crewmembers. On the basis of the responses received it was found that an average of 1 crewmember per vessel was used in addition to the operator in the Bristol Bay drift gill-net fishery. From 238 questionnaires with responses it was found that 31% was the average percent of gross earnings paid to crewmembers.
16. The opportunity cost of investment was calculated at a 12% yearly rate over a year on the market value of the vessel and drift gill-net gear. The market values on the survey were assumed to be the market values in 1977, the year the survey was conducted and were discounted by 6% to obtain an estimate of the market values in 1976. The value of the vessel was prorated according to the percentage of the gross earnings earned with that vessel in the salmon drift gill-net fishery. It was assumed that if the vessel was owned by a processor, the investment cost was zero for that vessel.
17. The Entry Commission asks everyone buying or selling an entry permit to indicate the price at which the transfer is made. This survey of permit transfer prices is voluntary, and the responses are kept completely anonymous. The opportunity cost of owning a permit is assumed to be 12% of \$2,536. That price, estimated from the permit transfer survey responses, was the average value of permits sold during 1976. In November and December of 1976 after the referendum election on Limited Entry, the value of a Bristol Bay drift gill-net permit rose to \$3,332, implying that the average price of the whole year was undervalued due to uncertainty about

INFORMATION ON THE DIFFERENT COST CATEGORIES USED IN TABLES 1 AND 2 (CONT.)

the election. (For more information on entry permit prices turn to Table 4.

18. Total costs is the sum of all cost categories (1-17). Since the survey was conducted through the mail, it was impossible to make sure that each fisherman answered every question. Whenever a blank occurred instead of an answer, that item on the questionnaire involved was ignored for the purpose of computing the average cost. For each cost category the number of responses used is in parenthesis next to the average. Since the total number of questionnaires is always in parentheses next to the average gross earnings, the number of blanks for each question can be readily computed. Note that this method of dealing with blanks gives an upward bias to the estimates of average costs since some the answers that were left blank could in fact be zero's.
19. These are the average gross earnings of those responding to the survey. None of the average gross earnings figures are based on information derived from the survey, but instead on information available to the Commission from fish tickets and estimates of average prices shown in Table 6 and 7. The average gross earnings does not include bonuses, or in-kind payments. This information is unavailable but it should be noted that the average gross earnings is higher than is shown in this report. It was found from 123 questionnaires with responses that 16% of the fishermen received a bonus. From this study and a survey that was one in 1974¹ by CFEC the data indicates that the average bonus for the 123 fishermen was close to 1% of their gross earnings.
20. Care is required in interpreting the "Net Return to Labor and Management" line. This could be a very good or very poor return depending on the amount of effort spent during the season. Some insight into the amount of effort spent during the season can be obtained by estimating the number of separate days or weeks on which a fisherman made landings with his boat. In the following estimates, multiple landings made on one day or during one week are counted as one day or one week of landings. Using this measure of effort, landings were made from the vessels surveyed on an average of:

¹

CFEC "Cost and Earnings of Alaskan Fishing Vessels - An Economic Survey" by James Owers, September 1974.

INFORMATION ON THE DIFFERENT COST CATEGORIES USED IN TABLES 1 AND 2 (CONT.)

<u>Sample Fleet</u>	<u>Number of Observations</u>	Average Number of Separate Days or Weeks On Which Landings Were Made					
		<u>Total</u>		<u>Number of Days</u>			
		<u>Weeks</u>	<u>Days</u>	<u>June</u>	<u>July</u>	<u>Aug.</u>	<u>Sept.</u>
TOTAL	243	4.9	13				
Grossing \$30,000 and Over	10	7.4	23				
Grossing \$20,000-\$29,999	53	6.0	16				
Grossing \$10,000-\$19,999	104	4.9	14				
Grossing \$1-\$9,999	76	3.7	9				
Resident of Bristol Bay	94	6.0	16	3.8	10.8	1.1	0.1
Non-resident of Bristol Bay	149	4.2	11	1.7	9.2	0.3	0.0
<u>Total Bristol Bay Drift Gill-Net Fleet</u>							
TOTAL	1,444	4.4	11				

Source: CFEC 1976 Vessel Multiple Listing dated 12/28/78.

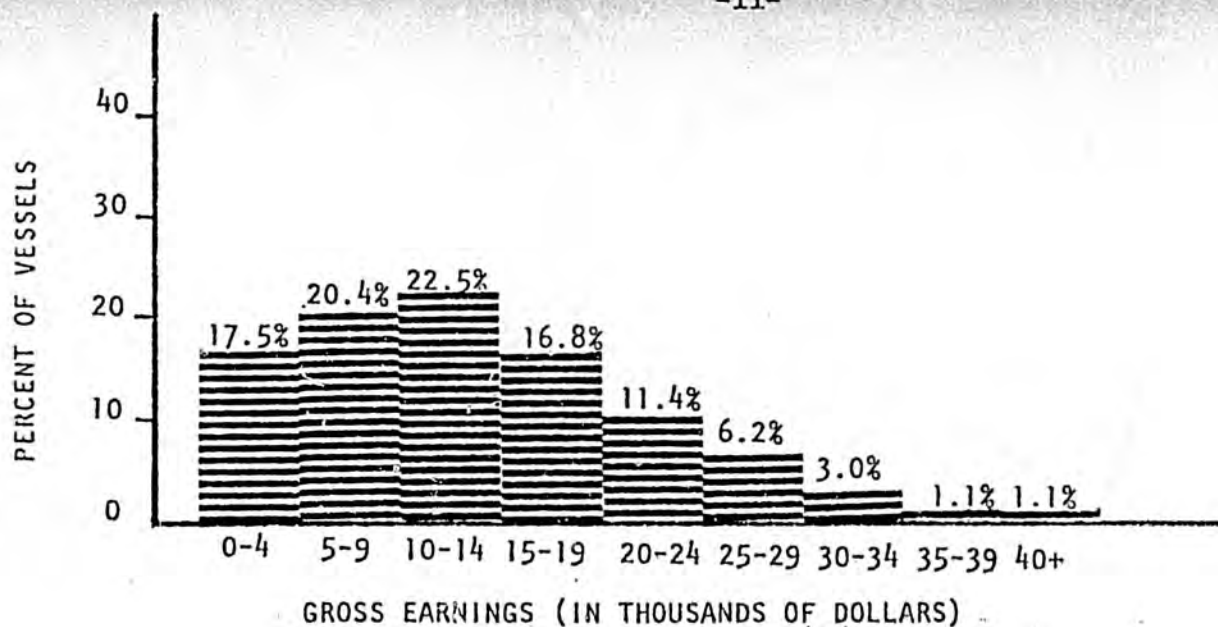


Figure 1.-Percent of the total Bristol Bay drift gill-net fleet per gross earning increments for salmon catch for 1976. (Based on 1444 vessels)

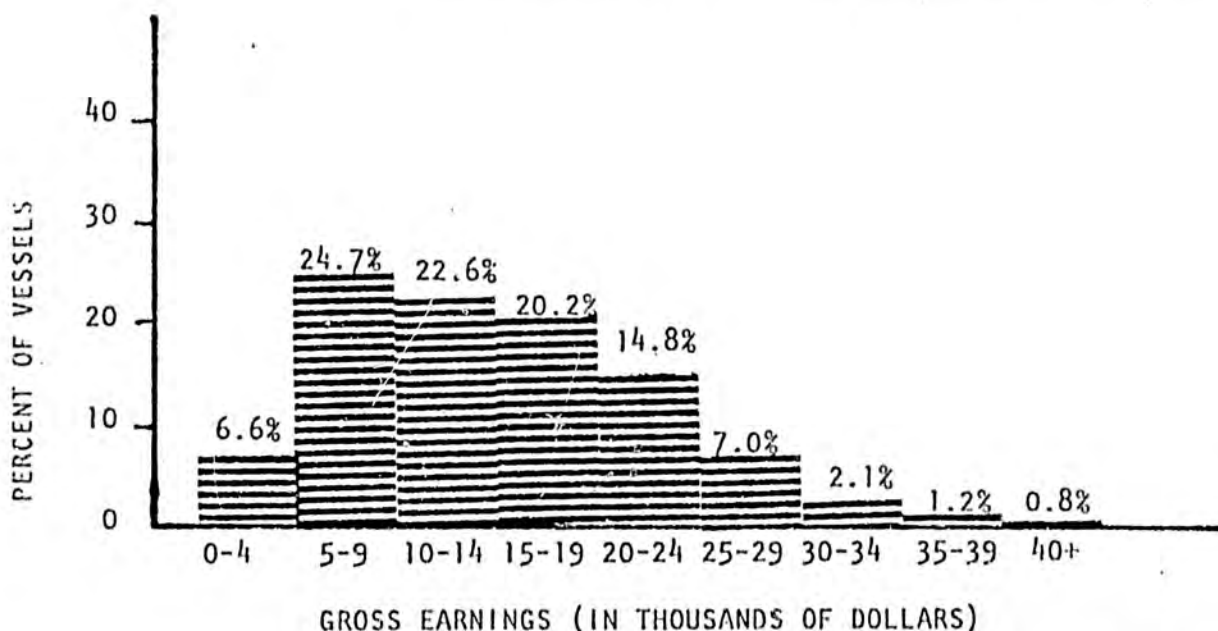


Figure 2.-Percent of the sampled Bristol Bay drift gill-net fleet per gross earning increments for salmon catch for 1976. (Based on 243 vessels)

Source: 1977 Bristol Bay Drift Gill-net Operating Cost Survey, conducted by Commercial Fisheries Entry Commission (CFEC); CFEC 1976 Vessel Multiple Listing dated 12/28/78.

ENTRY PERMITS STATUS AND PRICES

The following table presents some of the important statistics on permit status in the Bristol Bay Drift Gill-net Fishery.

TABLE 3

STATUS OF SALMON DRIFT GILLNET ENTRY PERMITS IN
THE BRISTOL BAY MANAGEMENT AREA, 1974-1977

Year	Number of Permits				Percent of Total Permits Used To Land Fish
	Permanent	Interim-Use	Total	Used to Land Fish	
1974	0	872	872	*	*
1975	1416	645	2061	1253	60.8%
1976	1621	99	1720	1370	80.0%
1977	1663	65	1728	1355	78.4%

*Data not available.

Source: CFEC "Number of Permits Fished by Year by Fishery", special computer run data March 1978, for 1977 it was run on December, 1978; CFEC Permit status computer generated files dated December 31st for each of the appropriate years; and CFEC Fishery List dated June, 1978 for 1975-1977.

Estimates of the average prices paid for drift gillnet entry permits around the state are listed in Table 4. These prices, obtained from the survey of fishermen buying or selling permits mentioned earlier, are averages of the prices which people who bought permits said they paid. The number of individuals who bought permits and who responded to our voluntary survey with price information are given in parentheses. These price estimates have not been converted into constant 1976 dollars.

TABLE 4

COMPARISON OF ALASKA DRIFT GILL-NET ENTRY PERMIT PRICES
BY AREA. AVERAGE PRICE ESTIMATES FOR 1975-1978.

*As of
**No estimate can be made.

Source: Survey conducted by the CFEC of individuals buying and selling permits;
data compiled by Elizabeth Stewart of the CFEC Research Staff.

The gross earnings by species of salmon for each year in Table 5 were estimated using the adjusted salmon prices (adjusted to constant 1976 dollars)² in Table 8, and the total yearly catch figures in Table 10. The total gross earnings in Table 6 are drawn from Table 5. Table 5 shows that between 1969 and 1976 gross earnings made from the red salmon catch was highest in 1970; for pink salmon it was highest in 1974, for chum salmon 1976, for coho salmon 1975, and gross earnings made from the king salmon catch was highest in 1971.

The average gross earnings in Table 6 are obtained using estimates of the total number of vessels making landings. The average gross earnings per permit holder who made landings has also been calculated in Table 6 for 1975 and 1976 (shown in parenthesis). Prior to 1975 this data was not available since commercial license numbers were not required on fish tickets; since that time Limited Entry permit numbers have been required and the data for gross earnings by entry permit holders is available from 1975. Table 6 shows (for all species of salmon) that the average gross earnings by vessel was at its highest in 1970 with 1971 following. This is due more to variations in pounds caught in the specified years than to price increases.

2

The method used to convert the price received by fishermen into constant 1976 dollars is outlined in the Appendix to this report.

TABLE 5

TOTAL GROSS EARNINGS IN THE BRISTOL BAY MANAGEMENT AREA
DRIFT GILL-NET FISHERY BY SPECIES FOR 1969-1976,
EXPRESSED IN CONSTANT 1976 DOLLARS

Gross Earnings in Constant 1976 Dollars					
Year	King	Red	Coho	Pink	Chum
1969	\$833,085	\$14,742,596	\$122,372	\$ 1,096	\$ 383,531
1970	828,977	40,264,450	16,563	209,057	609,129
1971	916,292	22,388,101	17,805	138	768,693
1972	486,698	6,756,978	30,961	55,271	280,769
1973	411,182	3,697,955	120,879	332	1,223,537
1974	572,440	4,057,494	118,602	1,018,927	665,730
1975	215,648	10,205,648	131,906	362	591,176
1976	755,003	15,427,007	52,056	979,060	2,708,699

Source: Tables 8 and 10.

TABLE 6
TOTAL AND AVERAGE GROSS EARNINGS IN THE BRISTOL BAY AREA
DRIFT GILL-NET FISHERY BY YEAR (1969-1976)
EXPRESSED IN CONSTANT 1976 DOLLARS

Year	Total Fishing Gross Earnings	Number of Different Vessels Making Landings	Average Gross Earnings Per Vessel
1969	\$16,082,680	1,674	\$9,607
1970	41,928,176	1,723	24,334
1971	24,091,029	1,718	14,023
1972	7,610,677	1,544	4,929
1973	5,453,885	1,291	4,225
1974	6,433,193	788	8,164
1975	11,144,740	1,376 (1,253)*	8,099 (\$8,894)**
1976	19,921,825	1,444 (1,370)*	13,796 (14,541)**

*Figure in parenthesis represents number of separate entry permits which were used to make landings in the Bristol Bay Management area in this year.

**Figure in parenthesis represents the average gross earnings per permit holder who made landings in this year.

Source: Table 5; CFEC "Catch Data Tabulation from Gross Earning File" prepared 11/17/78; CFEC "Number of Permits Fished by Year by Fishery" computer generated for 1975-1977 prepared March 1978.

EX-VESSEL PRICES, 1969-1976

The estimated prices³ received by the fishermen, shown in Table 7 and Figure 3(a-e), show a consistent pattern across all species. Prices were fairly stable between 1969 and 1972, rose rapidly in 1973 and 1974, fell during 1975, and then rebounded in 1976.

In Table 8 and Figure 4(a-e), the salmon prices have been adjusted into constant 1976 dollars to eliminate the impact of inflation. The price increases in this table and figure are not due to price inflation in the U.S. economy during this period, but to an increase in prices paid to fishermen for salmon relative to prices for other goods. Figure 4 shows that the price for each of the five species of salmon, expressed in constant dollars, has increased over the past eight years. The pattern of price changes has not changed much by inflating the years 1969 to 1975. For most of the species there is a distinct change in the level of prices in 1973; prices are substantially higher between 1973 and 1976 than they were between 1969 and 1972.

The price increases over the past eight years were not unique to the Bristol Bay salmon drift gill-net fishery, but occurred in other salmon producing areas of the state as well. Prices in Cook Inlet and Prince William Sound for drift gill-net caught salmon also show the same general upward trend, with a decline in 1975, and recovery in 1976.

³

The price per pound does not include bonuses, or in-kind payments.

TABLE 7

PRICES IN CENTS PER POUND, ROUND WEIGHT, TO THE
FISHERMEN FOR DRIFT GILL-NET CAUGHT SALMON IN
THE BRISTOL BAY MANAGEMENT AREA FROM 1969-1976

Year	King	Red	Coho	Pink	Chum
1969	19	24	18	11	11
1970	18	24	18	11	11
1971	22	26	20	12	12
1972	22	27	20	12	12
1973	31	35	30	17	19
1974	50	49	39	27	31
1975	40	40	38	28	30
1976	49	50	41	31	32

Source: Estimates by the CFEC, State of Alaska

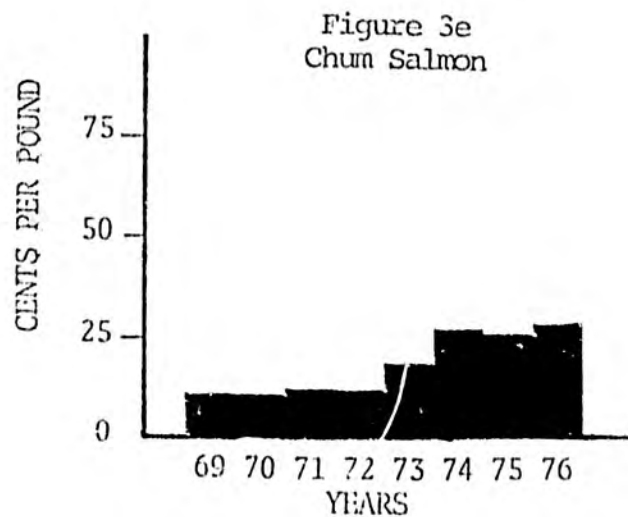
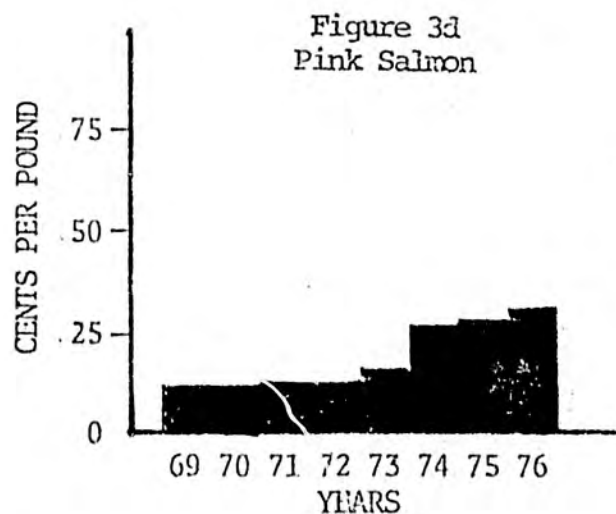
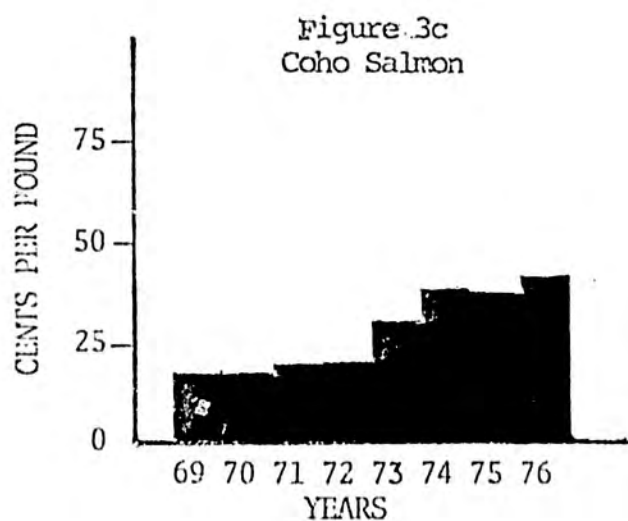
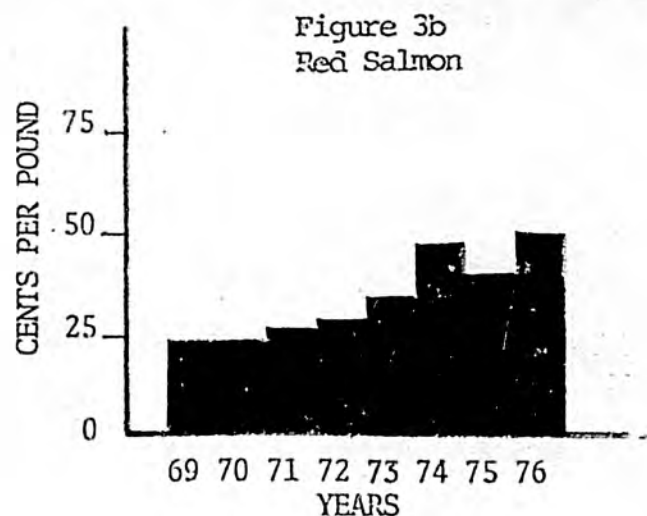
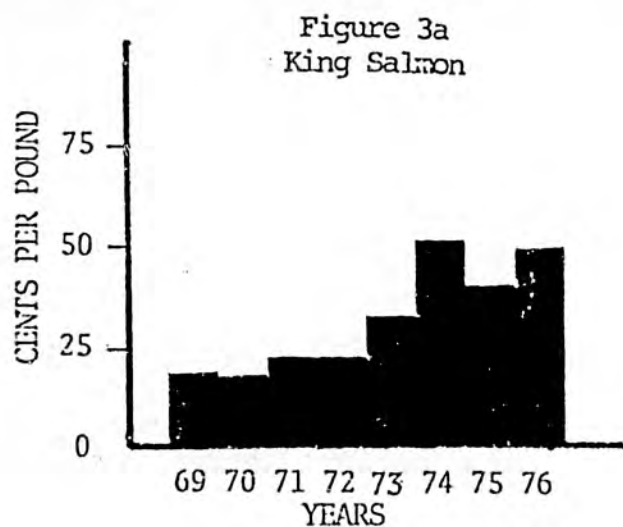


Figure 3(a-e).--Prices in Cents per Pound in the Round to the Fishermen for Drift Gill-net Caught Salmon in the Bristol Bay Area, 1969-1976.

TABLE 8

PRICES IN CENTS PER POUND, ROUND WEIGHT, TO THE FISHERMEN FOR
DRIFT GILL-NET CAUGHT SALMON IN THE BRISTOL BAY MANAGEMENT
AREA FROM 1969-1976. ADJUSTED INTO CONSTANT 1976 DOLLARS
USING THE WHOLESALE PRICE INDEX FOR ALL COMMODITIES.

Adjusted into Constant 1976 Dollars					
Year	King	Red	Coho	Pink	Chum
1969	33	41	31	19	19
1970	30	40	30	18	18
1971	35	42	32	19	19
1972	34	41	31	18	18
1973	42	48	41	23	26
1974	57	56	45	31	35
1975	42	42	40	29	31
1976	49	50	41	31	32

Source: Table 7; U.S. Department of Labor Wholesale Price Index for
all commodities, 1967=100.

Figure 4a
King Salmon

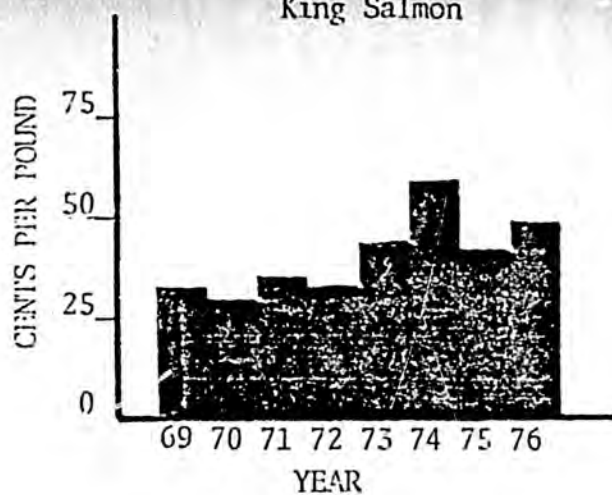


Figure 4b
Red Salmon

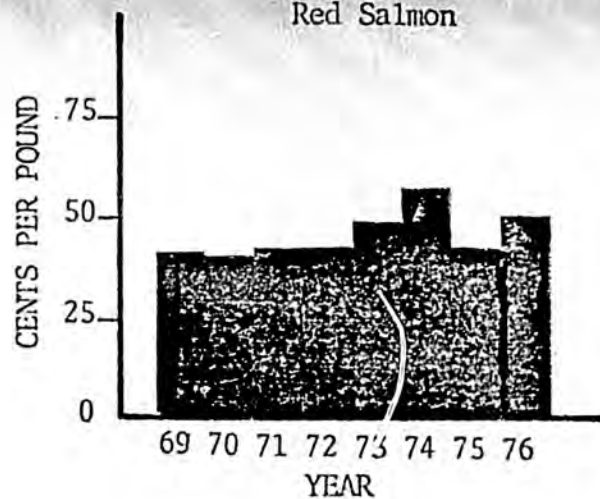


Figure 4c
Coho Salmon

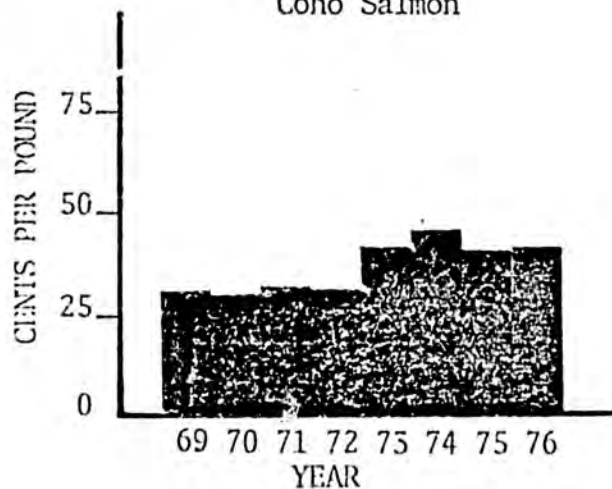


Figure 4d
Pink Salmon

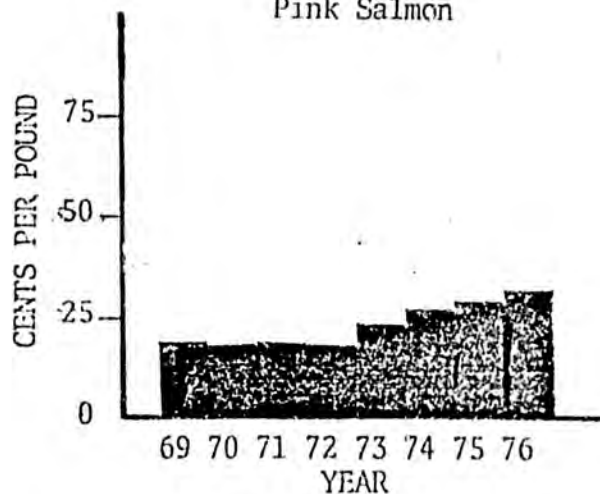


Figure 4e
Chum Salmon

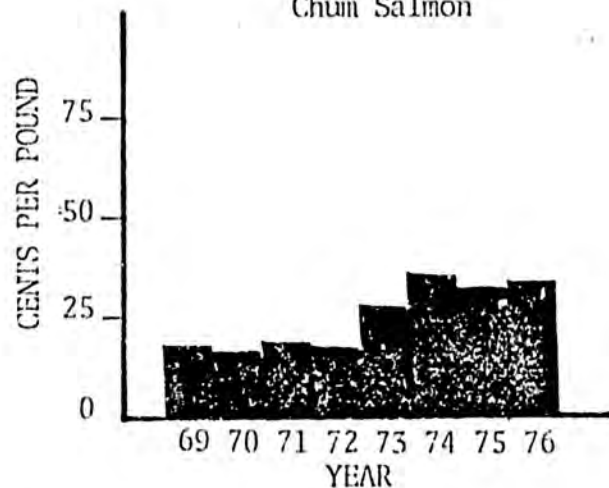


Figure 4(a-e).--Prices in Cents per Pound, Round Weight, to the Fishermen for Drift Gill-net Caught Salmon in the Bristol Bay Management Area from 1969-76. Adjusted into Constant 1976 Dollars Using the Wholesale Price Index for All Commodities.

CATCH BY SPECIES IN POUNDS, 1969-1977

The information in the following tables and figures is based on catch information from fish tickets, summarized in computer printouts from CFEC. Table 9 shows the monthly distribution of total pounds ^{landed} by each species of salmon harvested by the total Bristol Bay drift gill-net fleet from 1969-1977, while Table 10 and Figure 5(a-e) show the yearly catch patterns and trends clearly. It was found for the sampled fleet that during July, ~~1976~~ ^{fished} fishermen who were residents of Bristol Bay fished an average of 11 days while the non-resident fishermen fished an average of 9 days. Combining June, August and September the average number of separate days ^{fished} was 5 days for residents and 2 days for non-resident fishermen of Bristol Bay. This difference in the average number of days by month is due to the fact that non-resident fishermen are in the Bay for a short time to fish the peak of the red salmon run, while the resident fishermen of Bristol Bay focus on all species of salmon over a longer period of time, ^{as} this is shown in Table 11.

TABLE 9

MONTHLY DISTRIBUTION OF TOTAL POUNDS BY EACH SPECIES OF
SALMON HARVESTED BY THE DRIFT GILLNET FLEET
IN THE BRISTOL BAY MANAGEMENT AREA
1969-1977

KING SALMON				
Year	June	July	August	Other**
1969	1,527,129	959,647	1,805	35,920
1970	2,113,167	645,127	2,259	2,702
1971	1,817,076	796,317	4,562	21
1972	1,085,612	342,539	2,729	586
1973	795,630	159,908	3,789	19,677
1974	821,024	174,407	1,280	7,570
1975	284,374	227,734	1,299	41
1976	1,089,228	447,812	6,756	1,507
1977*	2,426,160	436,258	1,609	4,830
RED SALMON				
1969	6,213,169	29,716,989	18,181	9,211
1970	31,936,680	68,686,893	24,588	12,964
1971	4,940,718	48,238,998	119,547	5,740
1972	5,116,803	10,893,936	72,774	4,529
1973	1,837,155	5,780,159	86,704	55
1974	180,991	7,004,811	59,651	72
1975	67,008	24,105,999	125,115	1,059
1976	3,005,483	27,903,158	86,717	12,247
1977*	6,966,859	29,788,914	118,578	4,583
COHO SALMON				
1969	6	53,000	271,428	70,313
1970	0	19,286	35,923	0
1971	0	17,060	38,581	0
1972	15	7,803	78,720	13,537
1973	0	57,350	183,106	54,570
1974	30	31,350	192,316	39,883
1975	0	6,781	218,301	104,682
1976	0	8,200	75,031	44,114
1977*	2,123	136,621	446,619	138,023
PINK SALMON				
1969	382	5,308	77	4
1970	180	1,098,203	63,044	0
1971	26	669	30	0
1972	212	266,464	40,386	0
1973	224	1,202	19	0
1974	1,891	2,805,815	479,156	0
1975	0	1,148	97	4
1976	3,205	2,534,778	630,850	4,667
1977*	233	22,973	2,022	151
CHUM SALMON				
1969	40,898	1,876,148	101,267	271
1970	1,097,345	2,249,843	29,656	7,205
1971	370,152	3,427,241	243,507	4,851
1972	30,448	1,297,364	232,014	0
1973	372,560	3,960,239	372,992	122
1974	63,814	1,774,843	63,361	67
1975	385	1,792,954	113,679	0
1976	2,363,947	5,962,263	162,216	1,092
1977*	188,537	2,491,122	241,034	6,467

*Preliminary figures

**The majority of the catch was made in May and September.

Source: CFEC, "1976 Catch Data Tabulation from Gross Earning File; Computer printout dated 4/10/78, R01-03B-4550, for the specified years. For 1976-77 this printout is dated 12/31/78.

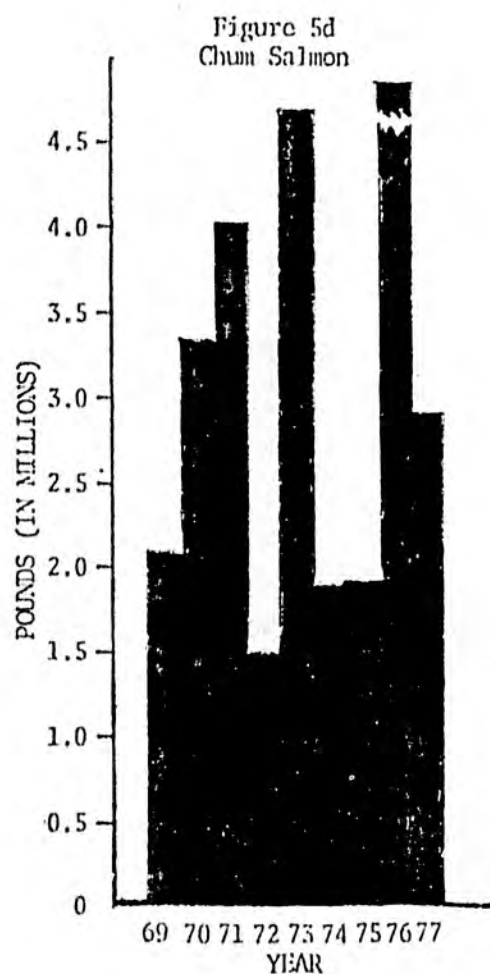
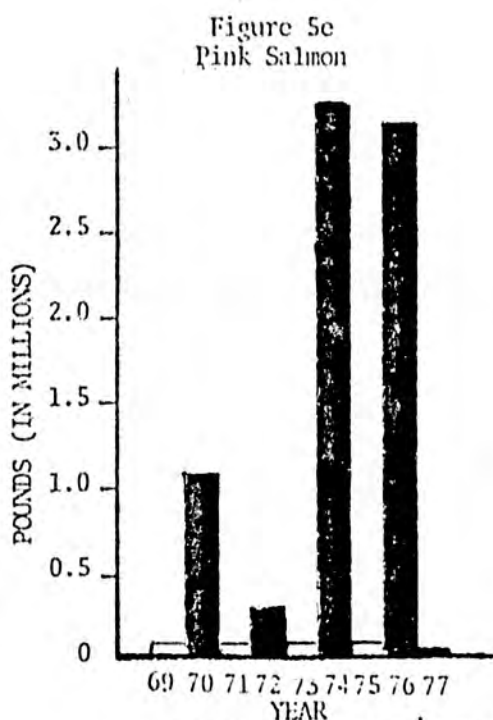
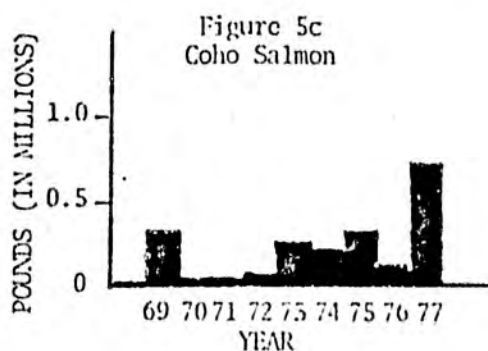
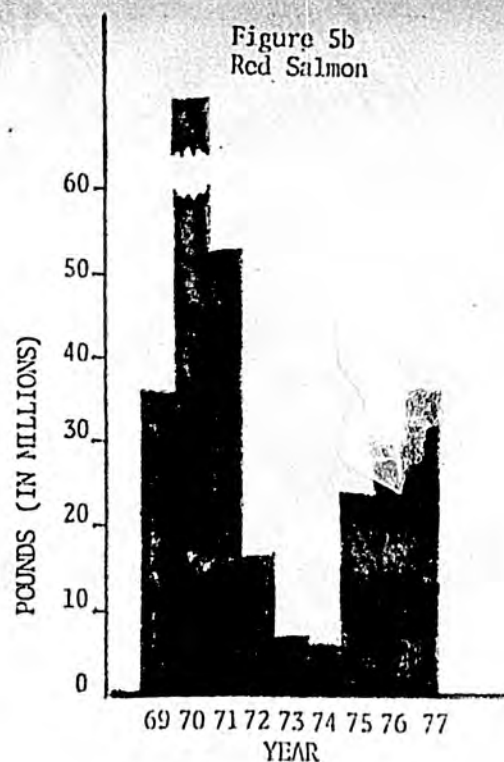
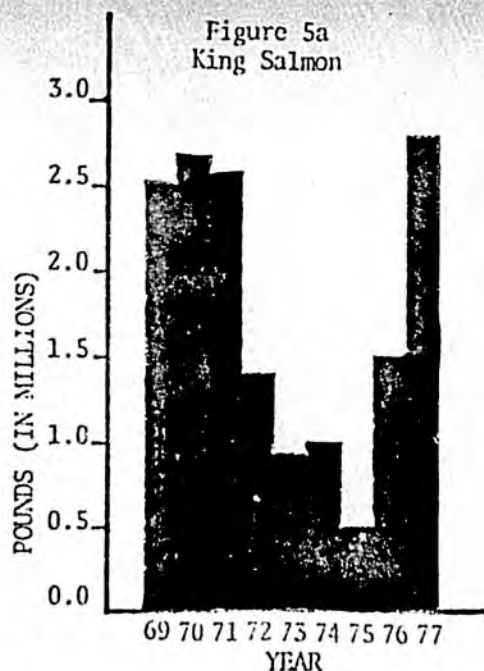
TABLE 10

TOTAL CATCH IN POUNDS BY YEAR FOR EACH SPECIES OF SALMON
HARVESTED WITH DRIFT GILL-NET GEAR IN THE BRISTOL BAY
MANAGEMENT AREA, 1969-1977

Year	King	Red	Coho	Pink	Chum
1969	2,524,501	35,957,550	394,747	5,771	2,018,584
1970	2,763,255	100,661,125	55,209	1,161,427	3,384,049
1971	2,617,976	53,305,003	55,641	725	4,045,751
1972	1,431,466	16,088,042	99,875	307,062	1,559,826
1973	979,004	7,704,073	294,826	1,445	4,705,913
1974	1,004,281	7,245,525	263,559	3,286,862	1,502,085
1975	513,448	24,299,161	329,764	1,249	1,907,018
1976	1,540,822	30,854,014	126,967	3,158,260	8,464,683
1977*	2,868,857	36,878,934	723,386	25,379	2,927,160

*Preliminary figures.

Source: Table 9 (but less 198,525 total pounds of salmon for 1976). This is due to fish ticket errors with gear codes. Table 10 reflects the corrected pounds, while Table 9 does not.



□ Pounds too small for measurement on this scale.

Figure 5(a-e).--Total Catch of Salmon with Drift Gill-net Gear in The Bristol Bay Area by Species and Year, 1969-1977.

TABLE 11

1976 TOTAL AND AVERAGE CATCH IN POUNDS BY SPECIES OF SALMON
FOR THE BRISTOL BAY DRIFT GILL-NET SAMPLED FLEET
BY RESIDENT AND NON-RESIDENT OF BRISTOL BAY

1976 Catch in Pounds by the Sampled Fleet;

Species of Salmon	Resident of Bristol Bay (94 Vessels)		Non-Resident of Bristol Bay (149 Vessels)	
	Total Catch	Average Catch	Total Catch	Average Catch
King	202,499	2,154	96,897	650
Red	2,014,587	21,432	3,673,565	24,655
Coho	18,818	200	6,330	42
Pink	227,040	2,415	304,963	2,047
Chum	886,997	9,436	718,304	4,821

Source: CFEC 1976 Gross Earnings by ADF&G by Specific Salmon Species,
dated 12/3/78.

A P P E N D I X

METHOD OF PRICE ADJUSTMENT

The prices received by the fishermen in any particular year (these are given in Table 7) were inflated by a factor designed to express them in 1976 dollars (shown in Table 8). The "inflation factor" for each year was obtained using the U.S. Department of Labor's Wholesale price index for all commodities. The index for the year whose price it was desired to inflate was subtracted from the index for 1976. The percentage increase in the index was then determined and the price was inflated by that percentage.

The multiplier for 1969 was calculated by finding that the difference between the indices 1969=106.5 and 1976=182.9 was 76.4. The difference meant a 71.4% increase in the index between 1969 and 1976. The multiplier for 1969 was therefore 1.717. The king salmon price received by the fishermen in 1969 was .19, the inflated price was $(1.717)(.19)$ or .326.

The following table shows the work involved in calculating the inflation factors.

Inflation Factor Calculations

Year _i	WPI _i *	WPI ₇₆ - WPI _i	% change in WPI between year _i and 1976	Inflation multiplier for year _i
69	106.5	76.4	71.74	1.717
70	110.4	72.5	65.67	1.657
71	113.9	69.0	60.58	1.606
72	119.1	63.8	53.57	1.536
73	134.7	48.2	35.78	1.358
74	160.1	22.8	14.24	1.142
75	174.9	8.0	4.57	1.046
76.	182.9	0.0	0.0	0.000

*for all commodities, 1967=100

Source: U.S. Department of Labor.

TABLE A-1

SUMMARY OF AVERAGE COSTS (Excluding Opportunity Costs) FOR DRIFT GILLNET
FISHING FOR SALMON IN THE BRISTOL BAY AREA IN 1976.

Cost Category	Averages for the Sampled Fleet				
	(A) Total Vessels	(B) Grossed \$30,000 and Over	(C) Grossed \$20,000-29,000	(D) Grossed \$10,000-19,999	(E) Grossed Under \$10,000
1. Insurance	\$ 225 (201)	\$ 467 (7)	\$ 348 (46)	\$ 206 (88)	\$ 132 (60)
2. Dues	78 (218)	102 (9)	78 (47)	78 (96)	75 (66)
3. Moorage & Storage	48 (178)	40 (6)	50 (38)	68 (72)	24 (62)
4. Administration	253 (199)	339 (7)	396 (40)	246 (90)	160 (62)
5. Vessel Repairs	774 (221)	899 (9)	940 (50)	809 (94)	588 (68)
6. Depreciation	626 (229)	772 (10)	938 (49)	657 (97)	355 (73)
7. License Fees	107 (243)	109 (10)	105 (53)	108 (104)	106 (76)
8. Fuel	295 (231)	423 (10)	418 (52)	276 (99)	213 (70)
9. Galley Expenses	274 (208)	474 (8)	357 (43)	272 (90)	200 (67)
10. Gillnetting Equip- ment Repairs	509 (162)	1,198 (7)	610 (36)	477 (67)	478 (52)
11. Borough Fish Tax	247 (137)	342 (6)	327 (26)	280 (58)	154 (47)
12. Travel & Freight	448 (210)	409 (8)	647 (44)	410 (88)	376 (70)
13. Special Clothes	123 (221)	123 (9)	148 (49)	127 (95)	115 (68)
14. Rental & Leasing	484 (151)	223 (7)	650 (34)	622 (56)	271 (54)
15. Crewshare	4,804 (238)	8,579 (10)	8,462 (53)	4,498 (101)	2,091 (74)
16. Interest Payments	129 (135)	215 (6)	316 (32)	80 (49)	48 (48)
17. TOTAL COSTS	\$ 9,424	\$14,714	\$14,790	\$ 9,214	\$ 5,386
18. Average Gross Earnings	\$15,143 (243)	\$36,245 (10)	\$24,031 (53)	\$14,459 (104)	\$ 6,817 (76)
19. NET RETURN TO LABOR AND MANAGEMENT	\$ 5,719	\$21,531	\$ 9,241	\$ 5,245	\$ 1,431

Source: 1977 Bristol Bay Drift Gill-net Operating Cost Survey, conducted by Commercial Fisheries Entry Commission; CFEC 1976 Gross Earnings by ADF&G by specific salmon species dated 12/78; Table 4.

TABLE A-2

SUMMARY OF AVERAGE COSTS (Including Interest) FOR DRIFT GILL-NET
FISHING FOR SALMON IN THE BRISTOL BAY AREA IN 1976.

Cost Category	Averages for the Sampled Fleet				
	(A) Total Vessels	(B) Grossed \$30,000 and Over	(C) Grossed \$20,000-29,000	(D) Grossed \$10,000-19,999	(E) Grossed Under \$10,000
1. Insurance	\$ 225 (201)	\$ 467 (7)	\$ 348 (46)	\$ 206 (88)	\$ 132 (60)
2. Dues	78 (218)	102 (9)	78 (47)	78 (96)	75 (66)
3. Moorage & Storage	48 (178)	40 (6)	50 (38)	68 (72)	24 (62)
4. Administration	253 (199)	539 (7)	396 (40)	246 (90)	160 (62)
5. Vessel Repairs	774 (221)	899 (9)	940 (50)	809 (94)	588 (68)
6. Depreciation	626 (229)	772 (10)	938 (49)	657 (97)	355 (73)
7. License Fees	107 (243)	109 (10)	105 (53)	108 (104)	106 (76)
8. Fuel	295 (231)	423 (10)	418 (52)	276 (99)	213 (70)
9. Galley Expenses	274 (208)	474 (8)	357 (43)	272 (90)	200 (67)
10. Gillnetting Equip- ment Repairs	509 (162)	1,198 (7)	610 (36)	477 (67)	478 (52)
11. Borough Fish Tax	247 (137)	342 (6)	327 (26)	280 (58)	154 (47)
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14. Rental & Leasing	484 (151)	223 (7)	650 (34)	622 (56)	271 (54)
15. Crewshare	4,804 (238)	8,579 (10)	8,462 (53)	4,498 (101)	2,091 (74)
16. Interest Payments	129 (135)	215 (6)	316 (32)	80 (49)	48 (48)
17. Opportunity Cost of Investment	1,372 (219)	1,754 (9)	1,979 (49)	1,411 (91)	847 (70)
18. Opportunity Cost of Holding a Permit	304	304	304	304	304
19. TOTAL COSTS	\$11,100	\$16,772	\$17,073	\$10,929	\$6,537
20. Average Gross Earnings	\$15,143 (243)	\$36,245 (10)	\$24,031 (53)	\$14,459 (104)	\$6,817 (76)
21. NET RETURN TO LABOR AND MANAGEMENT	\$ 4,043	\$19,473	\$ 6,958	\$ 3,530	\$ 280

Source: 1977 Bristol Bay Drift Gill-net Operating Cost Survey, conducted by Commercial Fisheries Entry Commission; CFEC 1976 Gross Earnings by ADF&G by specific salmon species dated 12/78; Table 4.

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MANAGEMENT APPROACHES FOR MARINE FISHERIES:

THE CASE OF THE CALIFORNIA ABALONE

by

Biliana Cicin-Sain, John E. Moore and Alan J. Wyner

**UNIVERSITY OF CALIFORNIA
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with the assistance of

H. Kenneth Hibbeln, Maynard Silva, Art Quadraccia

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PREFACE

The old belief that there are as many good fish left in the sea as were ever taken out of it is no longer tenable, as old-established fisheries decline, weakened by over-fishing. To recover, the depleted stocks of fish must be rested, but, even then, the great catching power embodied in modern fishing fleets makes impossible any return to uncontrolled exploitation... The days of the marine hunter appear to be numbered and in his place must come the 'estate management' of highly regulated international fisheries and of course the marine farmers.¹

While problems of resource depletion and hence the need for management vary greatly from fishery to fishery,² there is a growing recognition among both closely affected publics (i.e. fishery participants) and the general public that better management efforts are necessary to preserve threatened stocks of fish, and to protect the economic and social benefits derived from commercial and recreational fishing. The most recent example of this growing recognition is found in the Fishery Conservation and Management Act of 1976. This legislation extends United States jurisdiction to a 200-mile limit and establishes a national program for the conservation and management of the fishery resources of the United States. Its objectives are to prevent overfishing, to rebuild overfished stocks, to insure conservation, and to realize the full potential of the nation's fishery resources.

Methods of fishery management are numerous and vary according to the peculiarities of a particular fishery, its size, history, stage of development, methods of catch, etc. Nevertheless, in broad terms, three major approaches to fishery management may be catalogued: 1) methods which limit entry into the fishery (e.g. constraining the number of fishermen by some

means), 2) methods which control access to the resource (e.g. through the manipulation of fishing seasons, rotation of fishable areas, etc.), and 3) methods aimed at augmenting the resource (e.g. seeding, aquaculture, etc.). One should note that these methods are not necessarily exclusive of one another. Programs of limiting entry into a particular fishery, for example, may be complemented with a set of regulations limiting access to the resource and with a concerted scientific effort to artificially supplement the species -- either in a laboratory setting or under controlled natural conditions. The possible array of management options or combinations is vast, and compounds efforts to evaluate the potential effects of alternative management methods.

This report concentrates on the problems of managing the California abalone commercial and sport fisheries. While dealing with many policy-relevant issues, the report does not present a single, recommended management plan. Rather, it surveys the problems of the abalone resource, discusses the opinions that different affected groups have about the resource, and explores some of the consequences that may flow from different management approaches. Our goal is to provide information and analysis to policy makers, not to make policy.

To this end Chapter One presents a brief history of the development of the abalone fishery in California, describes some of the major characteristics of the industry, and reviews the methods which have been employed to regulate commercial abalone activity. A framework for evaluating fishery management plans -- with specific reference to abalone -- is offered in Chapter Two. In Chapter Three, data on what the various affected parties think about the abalone fishery and its management are presented; these

data result from extensive and varied interviewing. Chapter Four discusses the various political and administrative factors involved in developing an abalone management plan. This chapter uses legislation recently passed by the California legislature as a mini-case study. A final chapter gives a summary of the report and ends with some concluding remarks about the abalone resource and the possible impacts of different management options. Because of the special importance limited-entry plans are beginning to play in fisheries management, including the abalone fishery, the reader's attention is drawn to Appendix E where a survey of limited-entry plans worldwide is presented.

Any study that relies extensively on interviews and questionnaires incurs a debt to many respondents who cannot be identified individually. We hope that the commercial divers and processors, sport diving association officers and environmental group members who contributed their time to our project will recognize that this acknowledgement is directed to each of them.

While a smaller number of Fish and Game Commission and DFG officials were involved in this research effort, the imposition on their time was correspondingly greater. We would especially like to thank Richard Burge, Ed Greenhood and James Messersmith for their generous cooperation.

This research could not have been undertaken without the support provided by a California Sea Grant, nor completed without the assistance and collaboration of our Research Trainees -- Ken Hibbeln, Maynard Silva, and Art Quadraccia. Finally, the manuscript would not be available in legible form without the good work of our office manager, Phyllis Grifman.

Footnotes to Preface

- 1 Tony Loftas, The Last Resource (London: Hamish Hamilton, 1969), p. 53.
- 2 A good discussion may be found in J. A. Gulland, The Management of Marine Fisheries (Bristol: Sciencetechnica, 1974).

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Chapter 1

THE CALIFORNIA ABALONE FISHERY

Introduction

Abalone (genus Haliotis) is a single-shelled mollusk valued for the delicate flavor of its foot. Once it matures beyond the larval stage, the abalone settles to the ocean floor and -- dependent upon that singular, succulent foot -- remains essentially stationary for the balance of its life. In the eastern Pacific, various species of abalone are geographically distributed from Mexico to Alaska, but the most accessible and marketable species are concentrated in Mexico and California. Of the five species commercially harvested in California -- red, pink, green, black and white -- the depth of their location ranges from the intertidal zone (red, green and black) to as much as 200 feet (white).

History of the Fishery

The modern California abalone fishery was developed by Chinese laborers in the early 1850's.¹ Although limited to the intertidal zone by primitive techniques and gear, by 1879 they accounted for commercial landings in excess of 4 million pounds per year. By 1900 their success proved to be their undoing, as the coastal counties whose abalone resources were being depleted enacted ordinances prohibiting the sale of abalone gathered from the littoral zone. The Chinese were succeeded by Japanese divers whose virtual monopoly of hard-hat diving techniques enabled them to dominate the commercial fishery until World War II, when they were placed in detention centers inland. With access to marketable abalone dependent upon equipment that permitted their harvest in deeper waters, the number of commercial divers dropped, and so

did the size of their catch. By 1929 there were only 11 licensed commercial divers -- all of them Japanese -- and their catch in that year amounted to approximately 2 million pounds.

Since the California Department of Fish and Game (DFG) began to keep records of landings in 1916, the commercial abalone fishery has reflected three major trends: 1) a southward shift in the principal geographic loci of the commercial fishery; 2) episodic changes in the composition (by species) of the commercial harvest, and 3) a marked decline in total landings beginning in 1969.

The abalone fishery originated in Monterey, and was centered there until 1929, when it began a shift toward Morro Bay that culminated in 1940. Between 1940 and 1960 the "center" of the fishery was gradually dispersed from Morro Bay to Los Angeles, and thereafter increasingly concentrated in Santa Barbara. By 1974, landings in Santa Barbara accounted for nearly two-thirds of the total catch.²

The southward movement of the commercial fishery is attributable to a combination of harvesting pressures, legislative actions, and natural forces. The shift began as declining yields in the Monterey area prompted divers to range further south, where they discovered that the most abundant stocks of high quality red abalones were located along a 40-mile strip of the mainland coast between Cape San Martin and Cayucos. The commercial take from these beds reached a peak in 1945. As the yield from this source began to decline, an increasing number of divers began to harvest the less desirable pink abalones that had become accessible when the South Coast (from Point Conception to San Diego) and Channel Islands were opened to commercial diving in 1943. The entire north coast, from San Francisco to Humboldt Bay, was also opened

to commercial diving in 1943, but the catch was so modest and the public pressure to reserve this area for sport divers so great that the coast north of San Francisco's Point Lobos was closed to commercial divers in 1945 and it remains closed to date (1976).

The southerly shift of the commercial fishery was given added impetus in 1969 with a reduction in the legal size limit on the green abalones that are predominantly located in the south, and further reinforced by legislative actions in 1970 and 1971 that first permitted the drying and canning of abalones, and subsequently authorized their export. This opened a market for the previously discounted black abalones that were concentrated on the Channel Islands. At the same time the introduction of the speedier Radon-design boat made the Islands more accessible to commercial divers who might still be reluctant to risk the time and weather hazards entailed in crossing the channel to harvest the smaller blacks.

The present locus of the commercial fishery in Santa Barbara is in large part a result of its increased dependence upon abalone beds located off the Channel Islands. That dependence is in turn a function of depleted stocks on the mainland coast, and their depletion does not appear to be entirely a result of intensive commercial and sport diving. While the biological evidence remains a source of sometimes heated dispute, it seems that southern California abalones have become the victims of a kind of pincers action, attacked from the north by a resurgent sea otter population, and from the south by increasing numbers of sea urchins. The sea otter eats abalones, and the sea urchin competes with them for space and food. Moreover, any direct threat to the abalone population that may be posed by environmental degradation of the coastline south of Santa Barbara is compounded by its indirect effect on

the competition between abalones and sea urchins, as the latter are both more tolerant and mobile than abalones, and they grow faster.

As the preceding account indicates, changes in the central location of the abalone fishery have been interrelated with changes in the composition of the commercial harvest. Prior to 1945, the commercial catch consisted entirely of the comparatively larger and higher quality red species. By 1949, commercial landings were composed of nearly equal quantities of reds and pinks, and from 1950 to 1955, landings of pinks consistently exceeded landings of reds. The harvest of pink abalones reached a peak in 1952, when it exceeded the catch of reds by a margin of more than 2 to 1. As the accumulated stocks of legal-size pink abalones began to dwindle in 1955, the predominant catch alternated between reds and pinks until 1960. Thereafter -- with the exception of a three-year period between 1968 and 1970 -- landings of the faster growing reds have consistently exceeded the harvest of pinks, though landings of both species began to drop sharply in 1969. In that year the size limit on green abalones was reduced from $7\frac{1}{4}$ to 7 inches, and the catch of greens that had begun to achieve some commercial importance in 1964 enjoyed a temporary spurt until the windfall was exhausted in 1972.

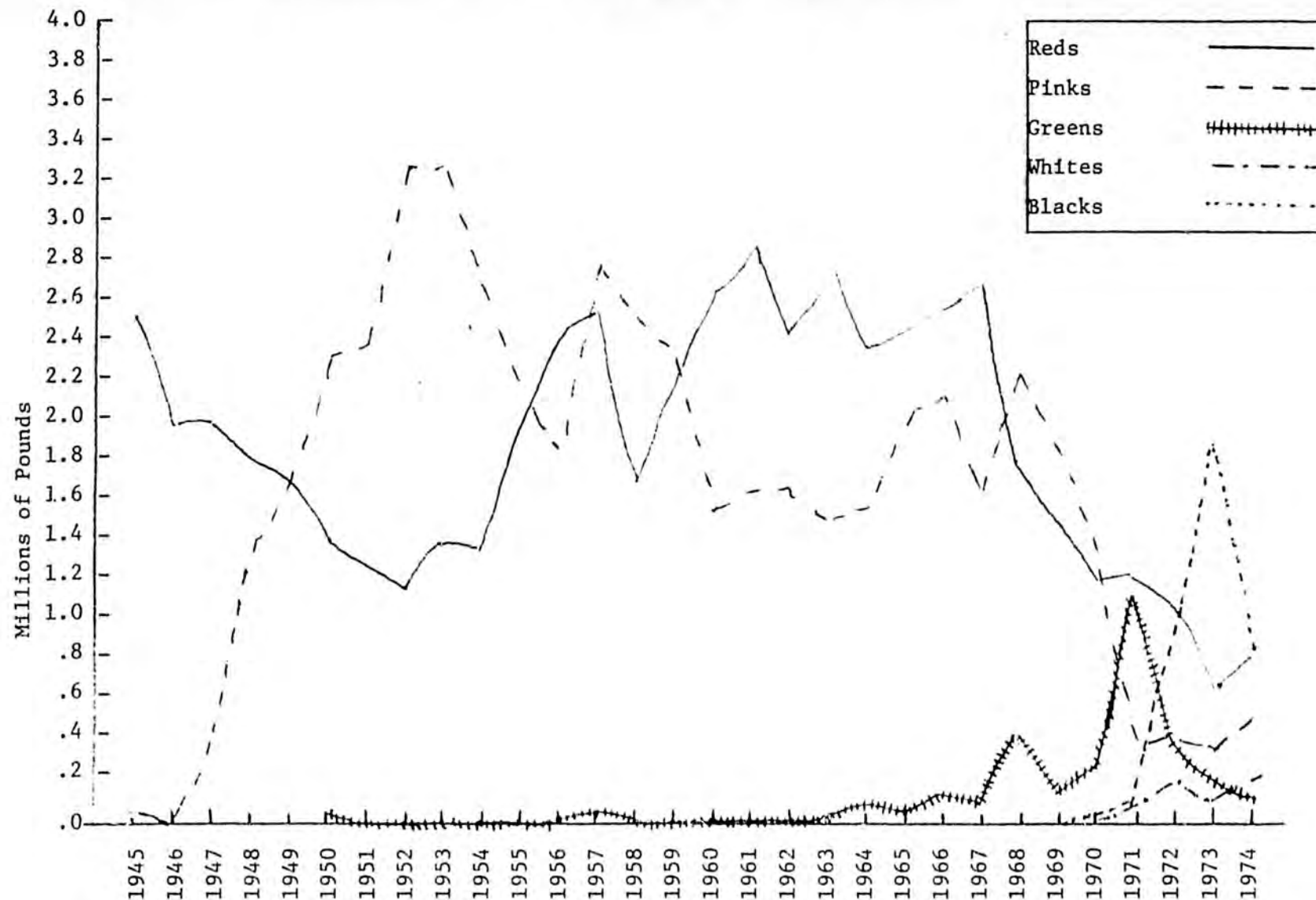
With the harvest of red, pink and green abalones dependent upon the annual growth of previously exploited stocks, an increasing number of commercial divers began to search out the less accessible white abalones that are concentrated in deeper waters off San Clemente Island and Cortez Bank. Although white abalones presently account for less than 10% of commercial landings, their total weight (in shell) has increased from a negligible 845 pounds in 1968 to an estimated 142,000 pounds in 1974, exceeding landings of green abalones by nearly 50% in that year.

The most recent and significant change in the composition of the commercial harvest was set in motion in 1970 and 1971, with the enactment of legislation permitting the drying, canning, and export of abalone. Beginning in 1971, landings of the smaller and lower quality black abalones soared from 15,000 pounds to a peak of nearly 2 million pounds in 1973, followed in the next year by the rapid decline (to 918,000 pounds) that accompanies the exhaustion of accumulated stocks.

Figure 1.1 summarizes the above discussion in graphic form. It should be noted that the data for this figure may not be altogether reliable with respect to the relationship between landings of pink and green abalones, as the landing tickets that provide the basis for DFG statistics sometimes fail to accurately distinguish species other than red.

Our summary of the shifting composition of the commercial abalone harvest traces a recurrent pattern of efforts to compensate for declining yields of the more desirable species by exploiting the virgin stocks of "new" species made accessible by legislative action, and marketable by the scarcity of high quality red abalones for the domestic market, or the opening of foreign markets for canned black abalones. By 1968 the skein had run out, and the temporary bonanza of smaller greens, the increased take of whites and the spectacular harvest of blacks only served to cushion the decline in total harvest that began the following year. From 1951 through 1968 total abalone landings never amounted to less than 4 million pounds; in 1957 they approached 5.5 million pounds, and as recently as 1968 they fell just short of 4.5 million pounds. By 1974 total landings had declined to approximately 2.6 million pounds, of which black abalones accounted for nearly 40%. (See Table 1.1)

Figure 1.1
California abalone landings by species, 1945-1974 (Pounds in Shell)



Source: Keith W. Cox, California Abalones, Family Haliotidae (state of California Department of Fish and Game, 1962), Figure 39, page 87, for the format and pre-1951 data. Richard Burge, Steven Schultz, Melvyn Odemar, Ibid., Table 1, page 21, for all data from 1950 to 1974. 1974 data in the table were projected from landings through June using 1973 landing rates.

Table 1.1

Annual Landings of Each Species (in millions of pounds shell weight) and
Average Adjusted Price per Dozen Paid to Diver, Including and Excluding
Blacks (1951-1974)

	Reds	Pinks	Greens	Whites	Blacks	Total	Av. Price /doz. Including Blacks(\$)	Av Price /doz. Excluding Blacks (\$)
1951	1.28	2.40	--			4.08		
1952	1.17	3.32	--			4.78		
1953	1.41	3.30	--			4.72		
1954	1.39	2.70	--			4.10		
1955	2.00	2.19	--			4.19		
1956	2.42	1.85	.01			4.28		
1957	2.57	2.80	.05			5.42		
1958	1.68	2.55	--			4.22		
1959	2.18	2.38	--			4.56		
1960	2.69	1.57	--			4.21	5.45	5.45
1961	2.87	1.68	--			4.55	6.07	6.07
1962	2.46	1.72	--			4.18	6.21	6.21
1963	2.81	1.50	.03			4.33	6.50	6.50
1964	2.37	1.61	.10			4.08	5.98	5.98
1965	2.49	2.07	.01			4.58	6.23	6.23
1966	2.66	2.16	.14			4.96	7.28	7.28
1967	2.69	1.62	.11			4.42	7.82	7.82
1968	1.78	2.27	.43			4.47	8.42	8.42
1969	1.56	1.90	.16	.03		3.66	8.90	8.90
1970	1.19	1.41	.27	.01	.02	2.90	9.92	9.07
1971	1.28	.39	1.13	.04	.11	2.95	9.58	9.87
1972	1.10	.40	.42	.14	1.01	3.09	10.35	14.70
1973	.66	.37	.16	.08	1.91	3.19	7.39	15.07
1974	.76*	.52	.10	.14	.92	2.44	10.50	16.68

* Projected from landings through June using 1973 landing rates.

Source: Richard Burge, Steven Schultz, Melvyn Odemar, Draft Report on Recent Abalone Research in California with Recommendations for Management (State of California Department of Fish and Game, Operations and Research Branch, January 17, 1975), Table 1, page 21 for all catch weights. Price data derived from personal interviews with processors in Santa Barbara and San Diego.

If demand had at least remained constant during the period from 1969 to 1974, one would expect declining supply to be accompanied by rising prices. The average price paid to the diver for a dozen abalones did increase from \$9.76 in 1969 to \$15.51 in 1974, but the rate of increase departed very little from changes in the consumer price index. The adjusted price per dozen (in 1967 dollars) was \$10.50 in 1974, compared with \$8.90 in 1969. This modest real increase in the value of the catch can be explained by the increasing proportion of black abalones: excluding blacks, the adjusted average price per dozen increased from \$8.90 in 1969 to \$16.68 in 1974.

What accounts for the declining yields depicted in Table 1.1? The following five factors offer an answer.

1. The harvest of all presently marketable species has become dependent upon the annual growth of immediate sub-legal classes of abalone -- barring a quota-free reduction in size limits, the opening of the north coast to commercial diving, or dramatic changes in gear permitting the harvest of white abalones in deeper water, there is no prospect of farther windfalls of accumulated stocks to augment the annual yield.

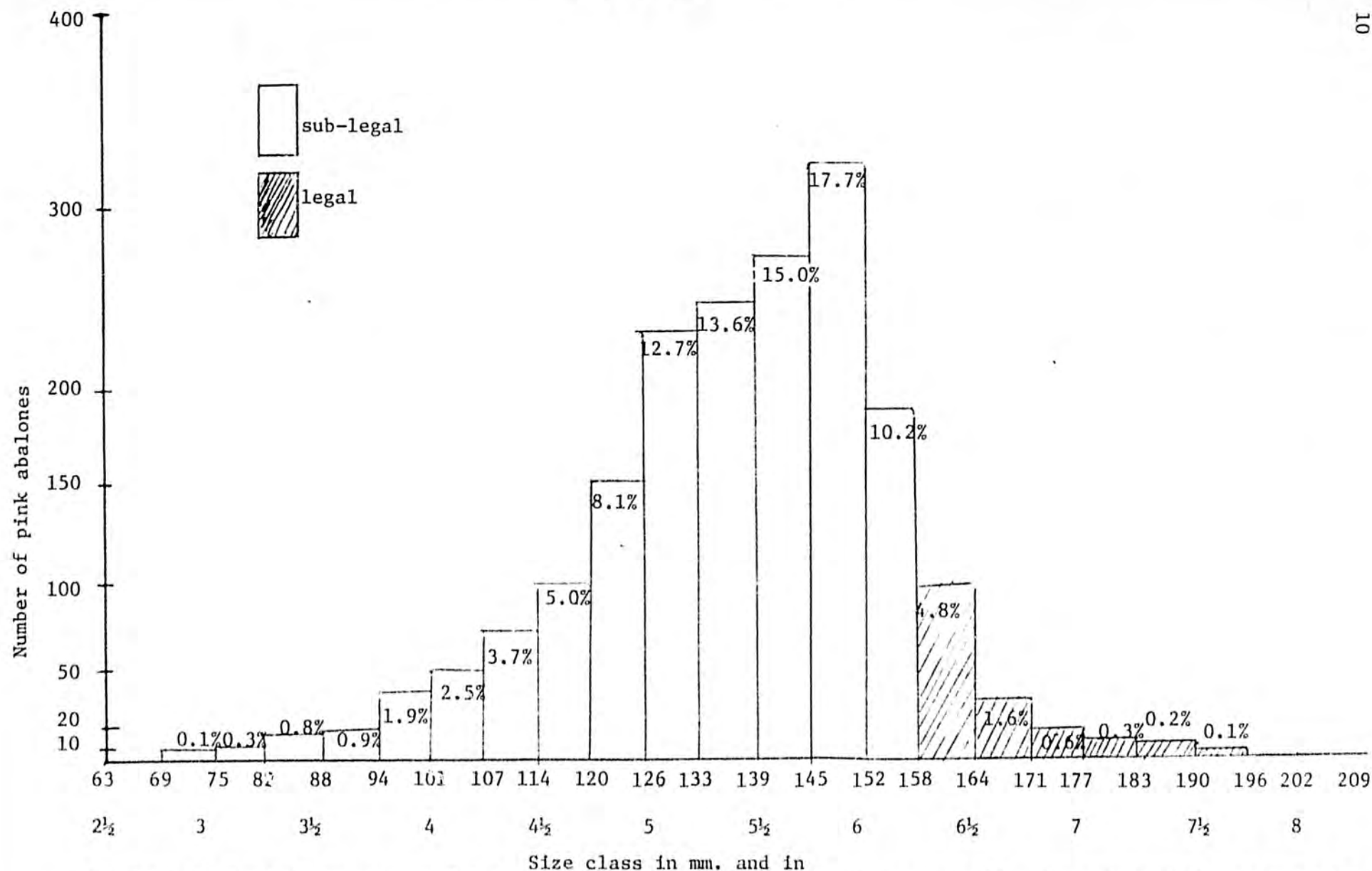
2. That annual yield is diminished by the mortality of abalones that are picked, measured, found to be short of the legal size limit, and thereupon replaced. Unless the abalone is free of injury from the bar used to pry it loose, the odds are that it will either bleed to death or become the victim of predators. In laboratory tests by the Department of Fish and Game, bar cuts as small as one-half inch in the foot of red abalones resulted in a mortality rate of nearly 60%; in the ocean, where abalones are subject to less favorable conditions in general and to predators in particular, DFG officials project a mortality rate approaching 100%.³ The impact on annual yield of

picking and replacing sub-legal abalones can only be estimated, but samples of successively larger size classes indicate an anomalous drop in the population of abalones within $\frac{1}{4}$ inch of the minimum legal size (see Figure 1.2). In the absence of some interference with normal growth patterns, the number of abalones in the immediate sub-legal class (6 to $6\frac{1}{4}$ inches) should at least equal the number in the preceding class ($5\frac{3}{4}$ to 6 inches). In fact, the population of immediate sub-legals shows a marked decline. This drop might be explained by the sport and commercial take of sub-legal abalones, but DFG surveys have led the agency to conclude that such illegal activities account for only a fraction of the loss.

3. The frequency with which sub-legal abalones are picked and replaced is thought to be a function of both the individual diver's experience and of the total number of divers competing for a diminishing annual yield of abalones. With respect to experience -- which enables divers to make reasonably accurate visual estimates of an abalone's size without prying it loose -- an analysis of the composition of licensed divers between 1973 and 1975 reveals that in any given year, over 30% were new to the fishery, and nearly 50% had less than two years' experience.⁴ As to overall pressure on the resource, while the decline in total landings dates back to only 1969, the catch per vessel and permit holder began to decline much earlier: In 1955, 74 vessels and 294 permit holders (including both divers and crew) landed 4,185,875 pounds of abalone, for an average of 56,566 pounds per vessel and 13,424 pounds per permit holder; in 1965, 164 vessels and 686 permit holders accounted for 4,576,084 pounds of abalone, for an average of 27,903 pounds per vessel and 6,671 pounds per permit holder; by 1974, the respective averages for 212 vessels and 554 permit holders were 12,200 and 3,743 pounds.

Figure 1.2

Size-class structure for 1778 pink abalone tagged at China Point and Pyramid Head, San Clemente Island during 1973



Source: Richard Burge, Steven Schultz, Melvyn Odemar, *IBid.*, Figure 4, page 50. The original figure has been modified somewhat.

Owing to the decreasing dependence of divers upon crew members, the deteriorating relationship between the number of commercial divers and the harvest of legal abalones has been even more pronounced than the preceding figures indicate. Both divers and crew members are required to obtain abalone fishing permits, but DFG records did not begin to segregate them until 1972. However, in a 1962 DFG bulletin devoted to California abalone, author Keith Cox estimated that only one-third of the 505 permits issued in 1961 were held by divers; in 1974, approximately three-fourths of 554 permits went to divers.⁵

4. Although the extent of impact on annual yields is again uncertain, there appears to be little doubt that the direct damage done to abalone stocks by commercial and sport divers has been compounded -- in some areas -- by the predation of sea otters, by the competition for food and space from sea urchins, and by the deterioration of coastal environments that had previously afforded a congenial habitat for abalone.

5. Whichever of the preceding factors may prove the greatest single threat to sustaining the annual yield of abalone, their combined impact may exceed their individual effect by reducing the density of certain beds to the point that recruitment is no longer adequate to replenish them.

As subsequent chapters will detail, there are substantial differences of opinion among affected interests with respect to the sources of declining abalone production, the nature of the problem posed by declining production, and the most appropriate measures for resolving "the" problem.

However "the abalone problem" may be defined, there is little disagreement that there is a problem, and that its impact is felt most keenly by the commercial abalone industry.

Table 1.2

Relationship Between Landings of Abalone (in pounds) and
the Number of Vessels and the Number of Permit Holders,

	Total Landings (pounds)	Number of Vessels	Number of Permit Holders	Pounds per Vessel	Pounds per Permit Holder
1955	4,185,785	74	--	56,566	--
1956	4,284,063	86	--	49,815	--
1957	5,421,914	94	--	57,680	--
1958	4,224,018	109	--	38,752	--
1959	4,561,827	98	352	46,549	12,960
1960	4,206,408	106	418	39,683	10,063
1961	4,553,766	124	505	36,724	9,017
1962	4,183,181	150	582	27,888	7,188
1963	4,343,879	128	532	33,936	8,165
1964	4,079,223	145	574	28,132	7,107
1965	4,576,084	164	686	27,903	6,671
1966	4,963,556	213	880	23,303	5,640
1967	4,421,581	206	853	21,464	5,184
1968	4,474,842	223	839	20,066	5,334
1969	3,658,078	213	840	17,127	4,355
1970	2,900,813	195	530	14,876	5,473
1971	2,945,318	191	486	15,420	6,060
1972	3,091,182	207	448	14,933	6,900
1973	3,193,150	212	487	15,062	6,557
1974	2,586,571	212	554	11,531	4,669

Source: Burge, Schultz, Odemar, *Ibid.*, Table 2, page 22. 1974 figures are derived from Department of Fish and Game current statistics; Pounds per Permit Holder figures have been calculated by the authors.

While our discussion to this point has concentrated on the commercial harvest, it should be recognized that thousands of sport divers have an equally legitimate claim to the resource. Certain of the regulations that are summarized toward the end of this chapter were expressly designed to safeguard that claim (e.g., the smaller size limit on red and green abalones taken by sport divers); other regulations designed to prevent depletion of the resource have indirectly benefited sport divers (e.g., the closing of certain areas -- including the entire north coast -- to commercial diving). The effect of these regulations has been to minimize competition between commercial and sport divers by concentrating their efforts in different areas or at different depths, but attempts to compensate for declining commercial landings or increasing sport diving effort may jeopardize this modus vivendi.

Characteristics of the Industry

The core of the abalone industry in 1975 consisted of 383 divers, 123 crew members, and approximately ten active processors. Extrapolating from the characteristics of divers included in a random sample of 1975 commercial permit holders (see methodological Appendix A for detail) nearly 50% of them were introduced to commercial diving through their family or friends, and another 24% through their experiences as sport divers. They were attracted to the fishery primarily by the anticipation of economic benefits, and secondarily by the enjoyment they expected to derive from the environment in which they would be working. A typical diver spends 100 days each year fishing, and an additional 55 days in related activities (e.g. maintaining his equipment). He owns his own boat, which in a majority of cases has been designed expressly for abalone fishing, and from it takes an average of approximately 400 dozen abalones per year. He is most likely to sell all of

his catch to a single processor, owing to convenience, a long-standing personal relationship, or dependence upon the processor for advances and equipment. He derives an annual gross income from his sales of about \$6,700.

Of course, any attempt to characterize a "typical" commercial diver obscures significant differences among individual divers. For example, the number of days per year devoted to diving ranged from 15 to 187; the annual catch from 1 to 3,240 dozen, and annual gross income from less than \$1,000 to more than \$20,000. While nearly two-thirds of the sample dove from their own boats, 23% relied upon other divers' boats, and 13% upon boats owned by processors. Although the majority of divers sell their catch to a single processor, almost 27% of them sell to more than one.

The most striking characteristic of the commercial diving population is a generally high rate of attrition that is especially pronounced among crew members and among divers with fewer than two years' experience in the fishery. Table 1.3 depicts annual attrition rates since 1972, when DFG began to distinguish between divers and crew.

Table 1.3
Annual Attrition Rates for Abalone Permit Holders, 1972-1975

	Composite attrition rate	Crew* members only	Divers only
1972 / 1973	41%	83%	26%
1973 / 1974	41%	76%	27%
1974 / 1975	50%	88%	34%

* The computation for crew members does not take account of 6 divers in 1972 and 5 in 1973 who renewed their permits after a one-year interval.

Attrition among divers is perhaps more notable for its principal source than for its overall level. Although our data do not enable us to discriminate the annual attrition of new entrants, a disproportionately high rate of turn-over among divers with fewer than two years' experience can be deduced from the composition of 1975 permit holders. Of the 383 divers who were issued permits in 1975, 258 carried over from 1974. Of those 258, 208 had obtained permits in three or more years. That leaves only 50 "carry-over" divers in 1975 who had been licensed for two years or less. There were 102 new entrants in 1973 and 138 in 1974. Thus of 240 divers who first entered the fishery in 1973 or 1974, only 50 remained in 1975 -- an attrition rate among new entrants, over a two-year period, of nearly 80%.

Tracing the names of DFG permit holders from 1969 through 1975 yielded a list of just over 200 divers who constitute a relatively stable core -- 106 who have held permits for more than six years, and 102 who have held them for three to five years. The imposition of a \$100 permit fee in 1970 was followed by a sharp decline in the total number of permit holders (including crew), from an average of 853 in the four preceding years to 530 in 1970. It seems reasonable to assume that most of those who continued to pay their fee year after year have more than a casual interest in commercial abalone diving. However, the fee is not so high as to discourage a significant number of either part-time or comparatively unproductive divers. This point is substantiated by the California Abalone Association's estimate that the 47 divers and 4 processors who comprised its membership in 1971 represented the harvesting capability of approximately 70 % of the abalone landings.⁶

With the volume of abalone landings diminishing and the ex-vessel price increasing, only a half-dozen firms process a significant volume of abalone (more than 80,000 pounds shell weight) on a regular basis. Although 17 firms obtained permits in 1975, seven of them did not process any abalone in that year. The remaining 10 were located in Half Moon Bay, Morro Bay, Santa Barbara, and San Diego, but two divers in Half Moon Bay held permits so that they could process their own catch, and the two processors in Morro Bay handled only a fraction of the total landings. This left three firms in San Diego and three in Santa Barbara processing 90% of the catch, with the Santa Barbara firms handling over two-thirds of it, and just one of them -- Pierce Fisheries -- receiving nearly half of the total catch.

Regulation of the Commercial Abalone Fishery

In 1945 the California legislature delegated regulatory powers over the abalone sport fishery to the Fish and Game Commission, but with a recent exception that is discussed in Chapter 4 (Assembly Bill 2224), it has retained regulatory authority over the commercial fishery. The following summary of measures employed to regulate the commercial fishery is presented in the order of their initial adoption.

Size Limits

Beginning in 1901, the legislature set a minimum size of 15 inches for all species, measured around the shell. Thereafter it established different limits for different species, and shifted the basis for measuring minimum size from circumference to maximum diameter. Through 1947 changes in size limits moved upward -- from 7 to 8 inches for reds, 6½ to 7½ for greens, and 5 to 6 inches for blacks. (The limit for pink abalones remained at 6 inches until 1970, when it was increased to 6½ inches.) In 1947 differen-

tial size limits were established for commercial and sport divers, reducing the sport limit on red and green abalones by 1 inch. Subsequent changes (since 1947), though apparently modest, may have had a substantial effect on the harvest of species whose accumulated stocks have been exhausted, or on the relationship between shell weight and marketable meat. These changes in size limits are indicated in Table 1.4.

Table 1.4
Size Limits for Commercially Harvested Abalones, 1947-1975

	Red	Pink	Green	Black	White
1947	8	6	7 $\frac{1}{4}$	6	↓
1955	↓	↓	↓	5	↓
1959	7 $\frac{3}{4}$	↓	↓	↓	↓
1969	↓	↓	7	↓	6
1970	↓	6 $\frac{1}{4}$	↓	↓	6 $\frac{1}{4}$
1972	↓	↓	↓	5 $\frac{1}{2}$	↓
1975	↓	↓	↓	5	↓

Area Closures

The scope of areas closed to commercial diving has been as broad as the entire state (1907 and 1908), and as narrow as the few miles of coastline between San Simeon Pier and Cambria State Park (1937). However, the most significant changes have involved the alternate opening and closing of the north and south coasts, with the coast north of Point Lobos (in San Francisco) having remained closed to commercial diving since 1945.

Species Restrictions

In 1909 the commercial catch was restricted to red abalones; in 1911 it was extended to pink, green and black, and in 1955 to all species.

License and Permit Requirements

A commercial diving license was first required in 1909, and four years later a modest \$10 fee was imposed. In 1939 commercial divers were also required to obtain a revocable annual permit. Apart from the imposition of a \$100 fee for abalone fishing permits in 1970, the most significant change in licensing procedures occurred in 1972, when the Fish and Game Commission temporarily required a 10-month apprenticeship to qualify new entrants for a commercial diving permit. Confronted with a number of requests for exemption from this requirement by experienced divers who sought to enter the abalone fishery, the Commission experienced some difficulty in rationalizing the apprenticeship program. In June of 1972 it amended the requirement to enable "qualified divers" who had obtained prior authorization from the Commission to demonstrate their proficiency through a test administered by the Department of Fish and Game, and in December the specification of Commission authorization was eliminated. This marked the demise of the apprenticeship program. The remnants of this short-lived experiment include two classes of permits -- for crew members and abalone divers -- and a proficiency test for diver applicants who have not previously held an abalone diving permit.

Season Closures

Together with size limits, this is the most conventional device for enabling a fishery resource to replenish itself. It was first applied to abalone in 1911, for a 4-month period between March 1 and July 1. The closed season was reduced to three months in 1913 (February 1 to April 30), and to two months in 1921 (from January 15 to March 15). Revised in 1933 to extend "between January 14 and March 16," the latter closure remained in effect until 1970, when -- at the request of the California Abalone Association --

the closed season was broken into two periods coinciding with the months of February and August.

Processing and Export

The drying of California abalones was prohibited from 1915 to 1970, when the legislature authorized both the drying and canning of abalones. The following year it also eliminated all provisions attaching to the export of canned abalone, which (with the exception of trimmings) had been unconditionally prohibited from 1913 to 1971.

Depth Restrictions

Some form of restriction on commercial harvesting of abalones in shallow waters extends back to the turn of the century, when county ordinances were adopted to foreclose the sale of abalones gathered in the intertidal region. In 1929 the state enacted legislation restricting commercial diving to waters 20 feet beyond the extreme low tidal line in District 7 (all of Mendocino and portions of Humboldt County), and in 1931 shifted to a vertical dimension with the prohibition of commercial diving in waters less than 20 feet deep in most of the Districts then open to commercial diving. The restriction was extended to all waters less than 20 feet deep from 1949 until 1974. when an exception was approved for certain of the Channel Islands, subject to recision by the Director upon finding that the resource is being endangered. While the present purpose of this 20-foot law is not altogether clear, it appears that the exception for the Channel Islands was facilitated by the absence of competition with sport divers in that remote location.

Gear Requirements

The de facto requirement of full deep-sea diving gear in waters more

than 20 feet deep was made de jure in 1943. In 1947 both commercial and sport divers were prohibited from taking abalone with any device more than 36 inches long. In 1954 gear requirements were specified to include a surface air pump operated from a boat, at least 100 feet of air hose, two baskets and a measuring device, all of which must be inspected and approved by the DFG.

Bag Limits

The only limit on the commercial abalone catch was applied to black abalones in 1974; it is unlawful to possess more than 20 dozen black abalones on any boat at any time. While this restriction could be viewed as a quota of sorts, it does not appear to be so intended, nor so perceived by commercial divers. The limit is near the maximum that a good diver might expect to harvest from legal beds, and it therefore helps to identify poachers who seek to make a big haul from areas that have been closed to commercial diving.

Recent Developments

In 1969 -- the year in which abalone landings began to decline so rapidly -- the owner/divers of one of the smaller Santa Barbara processing firms began an effort to organize the industry so that it could present a "uniform stand" on the various problems confronting it. Their organizational effort culminated in March of 1971 with the adoption of by-laws for the California Abalone Association (CAA). The principal objective of the Association is "to advocate equitable and sound regulation for the preservation, enhancement, and promotion of the industry."

The commercial divers and processors represented by the CAA contend that many of the regulations we have catalogued are inappropriate, and that as a whole they are inadequate to assure the effective management of the abalone

fishery. Dismayed by the initial unwillingness and subsequent inability of the DFG to do anything about the sea otter problem (owing to preemption by the 1972 Marine Mammal Protection Act), and frustrated by the collapse of the CAA-sponsored apprenticeship program, they still continued pressing their cause with the legislature, the DFG, and the Fish and Game Commission. In 1973 the Commission responded by directing the Department of Fish and Game to undertake an expanded research program that would provide the basis for management recommendations to be submitted by January of 1975. The resulting report and legislation will be explained in Chapter 4, following a discussion of alternative management concepts and differing attitudes toward the fishery in Chapters 2 and 3 respectively.

Footnotes to Chapter 1

- 1 Unless otherwise indicated, the material for this section is drawn from Keith W. Cox, "California Abalones, Family Haliotidae," Fish Bulletin No. 118 (California Department of Fish and Game, 1962).
- 2 Santa Barbara, 1,627,503 pounds; Los Angeles, 732,613; San Diego, 192,264 pounds; San Francisco, 40,045 pounds. California Department of Fish and Game: "California Marine Fish Catch" (1964-1972); "Statistical Report of Fresh, Canned, Cured, and Manufactured Fishery Products" (1973-1974); "California Fish Landings by Region--May, 1975."
- 3 Richard Burge, Steven Schultz, Melvyn Odemar, Draft Report on Recent Abalone Research in California with Recommendations for Management (State of California Department of Fish and Game, Operations and Research Branch, January 17, 1965), pp. 6-7.
- 4 Compiled from lists of divers and crew members supplied by California Department of Fish and Game.
- 5 Cox, op. cit., p. 80; 1974 data were calculated from information supplied by DFG.
- 6 Larry Pender, president of the California Abalone Association, in testimony presented to the California Fish and Game Commission. (State of California, Fish and Game Commission, Minutes, Meeting of November 5, 1971; mimeo).

Chapter 2

FISHERY MANAGEMENT PLANS: CRITERIA FOR EVALUATION AND THE CALIFORNIA ABALONE RESOURCE

Introduction

The state of California is the primary government involved in regulation of the abalone fishery. If an active role to preserve the fishery is undertaken by government, then the state legislature must pass legislation enabling or directing the California Department of Fish and Game to adopt an abalone management plan. Any such legislative or administrative actions must be consonant with the state Constitutional protection of the right to fish.¹

The state legislature recently adopted AB 2224 which restricts the number of abalone diving permits issued in any one year. In this legislation, the Department of Fish and Game and the legislature made the specific finding that limiting permits was necessary "to protect and enhance the state's abalone resources."² However, passage of AB 2224 is not likely to end all discussion and consideration of problems in the abalone fishery, and this report therefore considers the full range of techniques available for abalone management.

The primary goal of this chapter is the presentation of an analytic framework for assessing the consequences of different abalone management plans.³ Study of the abalone resource indicates the possibility of three distinguishable, but not necessarily mutually exclusive, approaches to abalone management: 1) Limiting entry to the fishery; 2) Controlling access to the resource; and 3) Resource augmentation. The chapter offers a

framework for evaluating the consequences of these three approaches, and provides a description of the main characteristics of each approach.

While this chapter presents a framework that encompasses all the salient and potentially feasible approaches to abalone management, subsequent chapters will present data which speak to many but not all of the consequences that flow from the different management options. Some of the data have been collected specifically for purposes of the current research, while other data will be abstracted from previous work. This report will concentrate upon what the various segments of the industry, sport divers, and government officials have reported to us about their perceptions of the feasibility and consequences of these different management options. As will hopefully become apparent in the context of this and following chapters, the consequences of some management approaches can only be estimated because of data limitations. These limitations stem from two sources. First, some raw biological and environmental data have not been collected at all, or not over long enough time periods to permit confident and universally accepted conclusions about the present condition of the resource and the factors responsible for it. Second, and most importantly, lack of experience in implementing abalone management plans precludes anything but estimates of some of the more subtle and difficult-to-measure consequences.

Framework

Chart 2.1 reflects the framework that guides this analysis of abalone management plans. The balance of this chapter will be devoted to a discussion of the factors that should be located within each cell in this chart. The objective of the present research is an assessment of the impact of different management plans according to five important criteria of evaluation:

Chart 2.1

Framework for Analyzing Fishery Management Plans

	Economic and Social Conse- quences	Biological Effective- ness	Political Feasibility	Administrative Feasibility	Legal Feasibility
Limit Entry to Fishery					
Control Access to Resource					
Augment Resource					

1) economic and social consequences; 2) biological effectiveness; 3) political feasibility; 4) administrative feasibility; 5) legal feasibility.

Any proposed management plan must take into account the likely results of the plan in each of these five areas. To avoid confusion the variables just listed should be explained and their usage in this research clarified.

Economic and Social Consequences

The point of reference for our discussion of economic consequences will be the notion of efficiency, defined in terms of optimizing the overall relationship between benefits and costs. The principal criterion for our consideration of social consequences will be the concept of equity. Equity refers to fairness in the distribution of benefits and costs; alternative management plans may have different consequences for the several sectors of the abalone industry. Some people stand to gain from any management plan and others may lose. It is quite unlikely that all will benefit. For instance, a plan that may increase the profits of processors may also make it economically impossible for part-time commercial divers to recover their costs, let alone make a profit.

The category of equity also must consider the consequences of a management plan for the larger public, both the fish-consuming and non-consuming public. For instance, plans that result in economic benefit to a sector of the industry may cause the retail price and/or availability of the commodity to create a hardship or inconvenience for the public. While abalone is certainly not a staple food resource, and is therefore not a "necessity," the impact of an abalone management plan on those who consume the species must be evaluated. And if an abalone management plan causes a retail buying shift away from abalone, the resulting increase in demand on other commodities may have

an impact on the price of these other commodities -- and therefore their availability -- to non-abalone consumers. In similar fashion, any attempt to protect the abalone resource by controlling the range of the sea otter may impose constraints on the population that does not necessarily consume abalone but derives pleasure from the presence of the otter. The equities of these kinds of shifts should be examined.

Biological Considerations

Clearly, the biological effectiveness of any management plan must be closely examined. A management plan must be based upon data that identify the major characteristics of the resource -- growth patterns, reproduction, feeding, etc. -- and the relationship of the resource to other species. The relationship between the resource and its environment should also be considered. In this regard, the impact of such factors as water quality, weather, availability of food and intrusion by man must be known and understood. This data collection and analysis may then lead to a definition of the maximum sustainable yield for the resource. Included in the definition must be whatever opportunities exist for augmenting the resource by the use of techniques such as seeding and planting from hatcheries.

A primary rationale for a more extensive governmental role in abalone management is the enhancement of the resource itself. Any plan is suspect if it would not promote (or at least prevent a deterioration in) the availability of abalone.

Political Feasibility

A management plan emerges from a political process. No matter how well conceived and articulated a management plan may be, it must be politically acceptable. That is, the approval or at least acquiescence of enough influ-

ential political actors is required before anything can be promulgated. Key political actors may come from the ranks of legislators, Department of Fish and Game administrators, representatives of various affected interest groups, rank and file fishermen and consumers. A careful analysis of the socio-economic profile of a fishery can yield valuable data in its own right and also contribute to an assessment of the political process through which a management plan must traverse. All the affected groups should be identified and each of their roles in the use of the resource tabulated. Not only their roles are important. Since the perceptions each of the affected groups has of the resource, its problems and possible solutions will help shape their future actions, they must be studied as well.

Another important point to keep in mind is that perceptions of political feasibility will influence the development of any plan because those involved in the development process usually will realize that approval must be secured from other persons, i.e. legislators, top administrators, and certain interest group representatives.

Because of the variety of perspectives from which the many political actors view fishery management and the different "power bases" they have, it is quite likely that conflict will emerge over any proposed management plan. One of the key functions of the political process is to resolve such conflict -- not necessarily to everyone's satisfaction, but nevertheless to resolve it. The point to remember is that the political process for fishery management is a conflictual one.

Administrative Feasibility

As administrative feasibility is used in Chart 2.1, it refers to the problems of implementing a public policy. In the case of abalone, the California

Department of Fish and Game is the lead agency. The three aspects of administrative feasibility that are of concern in this research are: 1) intra-organizational (within DFG) consequences of a management plan; 2) interorganizational consequences of a management plan; and 3) problems of enforcing a management plan. The particulars of any given management plan may impact the Department of Fish and Game differently. Some plans may necessitate internal adjustments of tasks, responsibilities, communication channels, or hierarchical relationships while other plans would permit continuation of the organizational status quo. Similarly, adjustments may be required in DFG's relationship with other organizations, including the legislature. And whenever a management plan is considered, one of the important issues that must always be raised is the enforcement aspect of the plan. Recognizing that all plans have enforcement problems, no plan is worth serious consideration if it permits too easy violation because of logistical or cost problems in enforcement.

Running throughout the considerations of administrative feasibility is the question of cost. Who pays for administration? Should the expense of any internal changes or enforcement efforts be carried entirely by the fishery being regulated? What part of the fishery -- those who actually take the resource, or those who process it or those who sell it or perhaps all of these parties? These and other administrative cost questions must be raised and answered when evaluating a management plan.

Legal Considerations

Regulation of offshore fisheries also involves some very important legal concepts and issues.⁴ Jurisdictional lines between federal and state efforts must be legally drawn and the rights of the affected groups determined and

rationalized into a management plan. While not undertaking a full-blown legal analysis, it is important for this research to take into account the legal status of any abalone management plan. Not only does the California constitution protect the right to fish, but the federal constitution guarantees of due process and equal protection may also become relevant in any legal challenges to an abalone management plan.

Management Options

This section explains the three basic management options which can be used separately or in concert to manage the abalone resource: limited entry, controlled access, and resource augmentation.

Limited Entry

Limiting entry to a fishery represents a major and commonly advocated approach. The underlying rationale here is based upon the assumption that a resource can be spared further decimation and stocks replenished if there are fewer people taking it. For example, if the problem is defined as too many people seeking too few abalone, then one obvious type of solution is to reduce the number of individuals involved.

Several ways of limiting entry to a fishery have been identified and discussed previously in Chapter One. This section focuses on some of the major techniques of limited entry as they might apply to abalone. These methods are not mutually exclusive, but for purposes of illustration each will be discussed separately and with the assumption that all else remains constant.

1) License limitations -- Assuming there is no change in the effort of individual divers, limiting the number of licenses issued each year should further the objective of holding constant or reducing the total resource take.

This technique assumes that the amount of reduction in resource yield will be closely related to the extent of reduction of license holders from current levels. However, the further assumption is made that in time the total resource yield will increase because there will be a much larger percentage of sub-legal size abalone growing to legal size than under wide open licensing. These are some ways of limiting licenses:

1A) Buy-back -- If the goal is to reduce the number of divers, then the state and/or the industry could buy back a certain percentage of the outstanding licenses. Such a program would require purchase of not only the license but also equipment associated with diving. How much to pay, how many licenses to buy back and when, and how to prevent newcomers from taking the "buy-back's" place are all problems which must be addressed. The idea of buying back has a certain appeal to some who argue that such compensation is the only fair technique to employ if the number of licenses is to be reduced.

1B) Auction and lottery -- If a decision is made to limit the number of sport and/or commercial license holders to any specified number, and if anticipated demand for these licenses exceeds the limit, then one method to allocate licenses is to hold an auction and accept bids. In a bidding procedure a minimum bid would probably be specified along with rules on how to handle duplicate bids if the process is by sealed bidding. The license holders could also be chosen at random through a lottery. The actual selection would probably be conducted in public. Some prerequisites for participating in the lottery -- such as experience or availability of gear and vessel -- could be imposed. Auctions or lotteries could be held for both commercial and sport divers if it seemed necessary.

1C) Grandfather clause -- A commonly suggested technique of limiting