

U.S. FRESH SALMON MARKET

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I. Introduction

For the past 25 years, ocean caught pacific salmon have dominated the U.S. and international salmon market. However, since 1981 advances in the culture of Atlantic salmon have added a new dimension to the fresh salmon market.

U.S. imports of fresh salmon have increased sharply in the past 5 years. In 1980, fresh salmon imports were about 1.6 million pounds and virtually all were shipped from Canadian wild salmon. By 1985, U.S. imports of fresh salmon had increased almost twelve fold to over 19 million pounds with most of the new supplies coming from Norwegian cultured salmon. The value of imports of fresh salmon was more than \$56 million in 1985. Norway's cultured salmon is entering the United States at about \$3.35/lb, roughly triple the price of Canadian fresh wild salmon imports.

World production of Atlantic salmon is expected to more than triple from about 27,000 M.T. in 1984 to 89,000 M.T. in 1990. Pacific farmed salmon is expected to increase from 5,000 M.T. in 1984 to 18,000 M.T. in 1990. Pacific wild salmon is expected to increase only slightly over the current level. Given the good image of Atlantic farmed salmon and current low levels of per capita consumption, the prospects for this increased output are good. The import price of fresh Atlantic salmon from Norway the major supplier, has been relatively stable at \$3.28-\$3.46/lb even though supply has increased 10 fold over the past 5 years. However price changes are likely to occur as these increased

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quantities continue to become available. Also, it is expected that the current profitability of the industry will vary with price changes.

This paper describes trend of U.S. salmon landings, imports, utilization, per capita consumption, price changes in the U.S. fresh salmon market. Further, this paper predicts the world cultured fresh salmon production in 1990 and the U.S. market, then estimates trend of price change of fresh salmon in the U.S. market by building demand models. Therefore this study can contribute for U.S. investors to explore cultured fresh salmon venture in the United States.

II. Outlook for U.S. Salmon Landings and Imports

1. U.S. Salmon Landings

The United States is a major producer of wild (ocean caught) pacific salmon. During the 1976-1985 period, the U.S. share of world landings ranged from 42 to 49 percent. U.S. commercial landings of wild salmon were 330,000 M.T.¹⁾ in 1985. For the past 5 years, U.S. landings have remained relatively stable, averaging 300,000 M.T. Total Chinook and Coho landings which are main species for fresh consumption in summer and fall have been relatively stable at 36,000 M.T. in 1985 (Table 1). U.S. production of farmed salmon production is small at less than 1,000 M.T. annually, but is expected to increase.

Table 1. U.S. Salmon Landings by Species 1976-85 (Thousand Pounds)

Species	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
*Chinook or King	34,511	32,676	39,776	33,008	28,533	31,071	34,602	34,424	21,711	27,187
Chum or Kda	52,645	57,398	50,485	45,784	84,910	98,880	92,123	79,920	113,340	92,499
Pink	99,237	125,644	184,873	226,830	253,541	257,106	231,472	194,140	275,615	319,139
Red or Sockeye	83,159	89,932	98,707	200,727	207,551	236,173	200,172	278,144	241,683	260,221
*Silver of Coho	39,690	29,992	30,648	29,767	39,270	25,210	49,151	52,665	39,060	27,900
TOTAL	309,242	335,642	404,489	536,116	613,811	648,440	607,420	639,293	691,409	726,946

Source: Fisheries of the United States

*Competitive with Atlantic Salmon

2. U.S. Salmon Imports

United States imports of fresh and frozen salmon were 27 million pounds (live weight) in 1985, or 13 percent of the apparent domestic consumption. The value of these imports was \$75.6 million.

United States imports of frozen salmon have increased less than two fold in the past 5

1) A metric ton equals 2,208 pounds

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years, from 4.7 million pounds in 1981 to 7.8 million pounds in 1985 (Table 5) while U.S. imports of fresh salmon have increased over ten fold from 1.8 to over 19 million pounds during the same period. Over 70 percent of the new supplies of fresh salmon from Norway (Tables 2,3,4,5). In 1985, the total value of imports of fresh salmon was more than \$ 56 million, which had increased almost twelve fold with over 80 percent from Norway's shipments.

Table 2. U.S. Imports of Fresh and Frozen Salmon

Year	1 9 8 1	1 9 8 2	1 9 8 3	1 9 8 4	1 9 8 5
Thousand Pounds	6,490	10,351	14,422	20,532	27,038
Thousand Dollars	15,933	22,110	33,385	55,248	75,595
Price, \$/Pound	2.45	2.13	2.31	2.68	2.80

Source: Fisheries of the United States

Table 3. U.S. Fresh Salmon Imports by Country

Country		1 9 8 1	1 9 8 2	1 9 8 3	1 9 8 4	1 9 8 5
CANADA	Pound	1,823,498	4,271,605	4,213,770	5,561,112	3,220,827
Pacific Salmon	Dollars	4,704,558	6,714,687	7,343,842	9,339,639	4,020,403
	Price, \$/Pound	2.58	1.57	1.74	1.68	1.25
NORWAY	Pounds	10,950	1,058,752	3,897,185	8,571,551	13,798,202
Atlantic Salmon	Dollars	37,929	3,570,657	12,780,957	28,343,600	46,255,973
	Price, \$/Pound	3.46	3.37	3.28	3.31	3.53
U.K.	Pounds	101	100	8,977	228,993	865,196
Atlantic Salmon	Dollars	564	575	32,852	812,635	3,003,373
	Price, \$/Pound	5.58	5.75	3.66	3.55	3.47
JAPAN	Pounds		469	149	610	297,848
Pacific Salmon	Dollar		2,525	749	1,266	218,171
	Price, \$/Pound		5.38	5.03	2.08	0.73
ALL	Pounds	1,839,435	5,463,115	8,197,466	15,046,890	19,274,686
COUNTRIES	Dollars	4,762,749	10,736,157	20,401,189	40,727,863	56,422,320
	Price, \$/Pound	2.59	1.97	2.49	2.71	2.93

Source: National Marine Fisheries Services, Office of Data and Information Management

Table 4. Monthly, U.S. Imports of Fresh Salmon, 1985, by Country

Country		January	February	March	April	May	June
CANADA	Pounds	63,156	25,212	72,312	28,320	138,349	77,997
Pacific	Dollars	66,672	72,226	230,019	83,672	423,382	123,693
	Dollars/Lb.	1.05	2.86	3.18	2.95	3.06	1.59
NORWAY	Pounds	1,059,784	1,216,449	1,757,422	1,220,357	1,409,388	962,746
Atlantic	Dollars	3,310,057	3,889,965	5,594,625	3,873,667	4,787,126	3,303,715
	Dollars/Lb.	3.12	3.20	3.18	3.17	3.40	3.43
U.K.	Pounds	38,278	96,807	113,483	74,189	105,937	107,022
Atlantic	Dollars	130,486	342,977	379,117	265,894	382,025	293,757
	Dollars/Lb.	3.41	3.54	3.34	3.58	3.61	2.74
ALL countries	Pounds	1,217,729	1,404,023	2,195,772	1,544,119	1,721,111	1,180,793
Atlantic and Pacific	Dollars	3,655,855	4,473,656	6,805,927	4,704,075	5,819,642	3,811,414
	Dollars/Lb.	3.00	3.17	3.10	3.05	3.38	3.23

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Country		July	August	September	October	November	December
CANADA	Pounds	388,740	238,189	323,909	621,147	866,795	376,701
Pacific	Dollars	929,551	455,983	536,645	459,978	424,506	214,076
	Dollars/Lb.	2.39	1.91	1.66	0.74	0.49	0.56
NORWAY	Pounds	1,070,116	778,882	765,594	936,390	1,051,467	1,566,607
Atlantic	Dollars	3,695,652	2,615,613	2,613,299	3,306,506	3,883,081	5,382,667
	Dollars/Lb.	3.45	3.36	3.41	3.53	3.69	3.44
U. K.	Pounds	63,236	43,086	75,011	71,265	38,516	38,356
Atlantic	Dollars	216,274	157,456	277,494	264,903	147,709	145,277
	Dollars/Lb.	3.42	3.65	3.70	3.72	3.84	3.79
ALL countries	Pounds	1,557,374	1,093,702	1,210,634	1,652,962	2,077,059	2,419,408
Atlantic and	Dollars	4,924,587	3,358,771	3,569,049	4,097,170	4,826,058	6,376,116
Pacific	Dollars/Lb.	3.16	3.07	2.95	2.48	2.32	2.64

Source: National Marine Fisheries Service, Office of Data and Information Management

Table 5. U.S. Frozen Salmon Imports by Country

		1981	1982	1983	1984	1985
CANADA	Pounds	4,535,104	4,791,086	6,076,359	5,052,884	7,484,646
	Dollars	10,726,553	10,995,260	12,465,897	13,663,264	18,228,195
	Price/ \$ Lb.	2.36	2.29	2.05	2.70	2.44
NORWAY	Pounds	17,856	22,086	131,372	167,222	70,624
	Dollars	72,955	84,550	467,844	609,844	223,232
	Price/ \$ Lb.	4.01	3.83	3.56	3.65	3.16
DENMARK	Pounds	94,882	59,121		18,832	116,384
	Dollars	362,313	240,172		66,925	447,761
	Price/ \$ Lb.	3.82	4.06		3.55	3.85
ALL	Pounds	4,650,408	4,887,797	6,224,828	5,486,759	7,763,366
COUNTRIES	Dollars	11,169,850	11,374,290	12,983,617	14,521,888	19,172,737
	Price/ \$ Lb.	2.40	2.32	2.08	2.65	2.46

The dramatic growth in U.S. imports of fresh salmon is shown in Table 3. Norway's exports of fresh Atlantic salmon to the United States were negligible in 1980 and 1981, and only 480 M.T. (\$ 3.6million) in 1982. However, in 1983, U.S. imported 1,768M. T. (\$ 12.7 million), which was more than triple the figure of the preceding years. In 1984, fresh salmon imports from Norway were 3,896 M.T. (\$ 28.3 million) or 120 percent above a year ago. In 1985, U.S. imports of fresh salmon from Norway were 67,272 M.T. (\$ 4,613 million), up 61 percent from a year earlier.

Over the past 5 years, the import price of fresh Norwegian salmon has remained relatively constant (Table 3). Norway's cultured salmon entered the United States in 1985 at about \$ 3.35/lb., roughly triple the price of Canadian fresh wild salmon imports (Table 4). The quality of farmed Norwegian salmon is normally judged as superior to that of wild salmon because conditions throughout the life cycle and subsequent handling can be more

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carefully controlled. Norway's salmon exports to the United States show a strong seasonal component that runs counter to U.S. salmon landings. These salmon imports are highest between November-May when U.S. salmon production is down. Imports from Canada, on the other hand, coincide with the Alaska salmon season and are priced less than Norwegian salmon exports (Table 4).

3. U.S. Utilization of Salmon

U.S. disposition of the salmon varies from year to year (Table 6 and 7). For example, in 1981, approximately 49 percent of the U.S. total supplies was used for canning; 31 percent was exported fresh or frozen; and the remaining 20 percent entered the domestic fresh and frozen market (or holdings). In 1985, however, the corresponding figures were

Table 6. U.S. Exports of Fresh and Frozen Salmon 1981-1985

	1981	1982	1983	1984	1985
FRESH AND FROZEN WHOLE:					
Thousand Pound	200,557	254,991	237,218	226,230	288,688
Thousand Dollars	368,037	412,969	356,781	341,060	462,194
Price/ \$ Pound	1.83	1.62	1.50	1.51	1.60
FILLETS & STEAK:					
Thousand Pound	3,573	1,701	977	2,808	956
Thousand Dollars	6,289	3,167	1,528	5,572	2,037
Price/ \$ Pound	1.76	1.79	1.56	1.98	2.13
CURED ROE:					
Thousand Pound	19,568	18,784	18,725	19,506	20,022
Thousand Dollars	94,184	80,750	70,660	65,833	66,746
Price/ \$ Pound	4.81	4.30	3.77	3.38	3.33

Table 7. U.S. Supply and Use of Salmon and Per Capita Consumption of Fresh and Frozen Salmon

	1981	1982	1983	1984	1985
(Metric Tons-Live Weight)					
SUPPLY					
Initial Inventory	15,642	13,158	28,866	23,315	24,329
Landings	294,130	275,524	289,981	314,277	330,430
Imports	3,474	5,540	7,719	9,590	12,290
Total	313,246	294,222	326,567	347,182	367,049
USE					
Exports Whole	95,521	121,447	112,981	102,832	131,222
Steaks	2,253	1,116	616	1,276	435
Canned	152,699	83,044	120,629	128,268	107,940
Ending Inventory	13,158	28,866	23,315	24,329	35,477
Total	263,630	234,472	257,542	256,705	275,074
Apparent Consumption of Fresh & Frozen	49,616	59,750	69,025	90,477	91,905
(Pounds-Live Weight)					
Per Capita Consumption of Fresh and Frozen	0.47	0.57	0.65	0.84	0.85

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29 percent for canning, 36 percent for exports, and 25 percent for domestic fresh and frozen use.

U.S. apparent consumption of fresh and frozen salmon has sharply increased from 50,000 M.T. in 1981 to 92,000 M.T. in 1985, up 86 percent over the five years. Annual per capita consumption of fresh and frozen salmon has increased steadily from 0.47 pounds in 1981 to 0.85 pounds in 1985 (Table 7). Although U.S. fresh salmon consumption data are not available...an analysis of import data suggests that imports of fresh Atlantic salmon have contributed to this increase in consumption.

Table 8. Annual U.S. PER Capita Consumption of Imported Fresh Salmon(Live Weight)

	1981	1982	1983	1984	1985
Imports, 000 Pounds	1,839	5,463	8,197	15,046	19,274
Population, Million Persons	227.7	229.0	232.0	234.8	237.8
Consumption per Capita (Pounds)	0.008	0.024	0.035	0.064	0.081

III. Outlook for Fresh Salmon Production and Markets

1. Outlook for Fresh Salmon Production

In 1983, world production of pen-farmed salmon, Atlantic and Pacific, was 21,000M.T. ; of this total, approximately 18,000 M.T. was Atlantic salmon. By 1990, world production of cultured salmon could exceed 100,000 M.T. If world landings of all species of salmon from wild stock remain close to the 1978-1982 average of 567,000 M.T., then the Atlantic salmon aquaculture share of world supplies would grow from 5 percent to 18 percent over the 1983-1990 period (Tables 9, 10, 11 and 12).

Table 9. World Production of Salmon by Species 1970-83 (Metric Tons)

	1970	1971	1972	1973	1974	1975	1976
Atlantic							
Wild	11,277	10,808	10,901	12,704	11,873	12,147	8,692
Farmed	10	60	350	700	850	1,200	1,800
Total	11,287	10,868	11,251	13,404	12,723	13,347	10,492
Pacific(Wild)							
Chinook	24,000	25,800	24,000	27,400	24,100	24,800	27,000
Chum	113,700	105,900	137,700	125,300	121,100	127,900	123,200
Coho	43,300	43,400	34,200	38,900	43,000	31,900	38,600
Pink	133,500	178,800	93,900	151,200	94,000	170,000	145,400
Sockeye	106,400	78,900	43,900	55,600	126,400	38,500	60,100
Masu	—	—	3,300	4,200	3,100	3,900	3,800
Total	420,900	432,800	337,000	402,600	411,700	397,000	398,100
TOTAL ALL SALMON	432,187	443,668	348,251	416,004	424,423	410,347	408,592

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	1977	1978	1979	1980	1981	1982	1983
Atlantic							
Wild	8,963	7,166	8,063	10,107	9,316	8,562	7,518
Farmed	2,537	3,750	4,620	5,598	9,555	13,792	17,795
Total	11,500	10,916	12,683	15,705	19,471	22,354	25,313
Pacific(Wild)							
Chinook	26,300	25,400	25,200	23,100	21,700	21,700	19,784
Chum	118,700	122,800	150,100	166,100	179,600	191,300	188,850
Coho	31,200	31,200	34,700	32,800	28,500	39,900	34,445
Pink	224,500	183,900	249,200	225,700	281,100	242,800	252,830
Sockeye	64,500	75,600	109,000	108,300	133,400	123,100	164,000
Masu	3,800	3,600	2,700	2,700	3,000	3,000	3,300
Total	469,000	442,500	570,900	558,700	647,730	621,800	663,209
TOTAL ALL SALMON	480,500	453,416	583,583	574,405	666,771	644,154	688,522

Source: FAO Production Statistics(Various)

Table 10. World Salmon Supplies to 1990: Projections (Metric Tons)

	1983 (Actual)	1984 (Actual)	1985 (Estimated)	1986	1987	1990
Atlantic Salmon: Wild Total	7,518	7,000	7,000	7,000	7,000	7,000
Atlantic Salmon: Farmed Total	17,795	26,748	36,500	50,600	69,700	89,000
of which from						
Norway	14,956	22,196	30,000	40,000	55,000	65,000
Scotland	2,539	3,912	5,000	7,000	9,000	15,000
Ireland	300	340	700	1,000	1,000	2,000
Faroes		300	600	2,400	4,000	6,000
Other European			100	100	200	300
North America			100	100	500	700
Atlantic Salmon: Wild and Farmed Total	25,313	33,748	43,500	57,600	76,700	96,000
Pacific Salmon: Wild Total	663,209	696,700*	640,000	650,000	670,000	670,000
of which						
Chinook	19,784	n/a	n/a	20,000	20,000	20,000
Coho	34,445	n/a	n/a	38,000	40,000	40,000
Pacific Salmon: Farmed Total	3,550	5,600	7,200	10,600	13,000	18,000
of which						
Chinook	50	100	200	600	1,000	3,000
Coho	3,500*	5,500*	7,000	10,000	12,000	15,000
Pacific Wild & Farmed Total	666,759	702,300	647,200	660,600	683,000	688,000
TOTAL ALL SALMON	692,072	736,046	690,700	718,200	759,700	784,000

*Estimates

n/a-not available

Source: Markets Reports, The Market for Scottish Grown Salmon by Susan Shaw and Jenny Ronn, Department of Business Studies, University of Stirling, Scotland

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Table 11. World Production Pen-Farmed Salmon 1981-83 and 1990 Projection(Metric Tons)

Species/Country	Year			
	1981	1982	1983	1990 P
Norway	8,907	10,266	17,016	80,000
United Kingdom	1,000	2,100	2,500	8,500
Ireland	80E	103	256	2,000
Canada	35	140	180E	1,000
Faroe Islands	100E	130	160	2,000
Sweden	60E	80E	100E	500
Iceland*	20E	30	50	300
Finland	30	30	30	200
France	2E	5E	10E	30
Total	10,234E	12,884E	20,302E	94,530
Pacific				
Japan	1,150	2,122	2,900	8,000
United States	450E	680E	900E	1,800
Canada	176	200	220E	450
Chile	60	80	100	3,000
France	60	80	80	500
New Zealand	2E	5E	10E	50
Total	1,898E	3,176E	4,210E	12,800
Grand Total	12,132E	16,051E	24,512E	107,330

P-Projected

E-NMFS estimate

*-Includes Ocean Ranching

Source: Branch of Foreign Fisheries Analysis, National Marine Fisheries Service, NOAA, U.S. Department of Commerce. (Most figures are based on the latest available statistics; estimates were prepared by the Branch)

Table 12. World Trade in Fresh and Frozen Salmon 1984(Metric Tons Actual Product Weights)

Imports into:														
Export from	Canada	United States	West Germany	United Kingdom	Bene-lux	France	Italy	Netherlands	Denmark	Sweden	Japan	South Africa	Others	TOTAL EXPORTS
Canada	—	4,847	657	917	445	6,330	898	72	678	1,422	4,760	73	1,681	22,780
United States	8,140	—	1,322	2,503	1,085	9,464	416	435	1,239	2,394	78,745	162	825	106,730
Japan	9	119	—	24	8	324	—	—	—	1	—	—	771	1,256
Norway	—	3,968	3,059	1,804	300	4,944	7	1,153	1,700	1,015	289	—	2,054	20,293
United Kingdom	—	108	23	—	52	1,142	—	380	—	—	—	—	84	1,789
Ireland	—	—	—	382	1	227	—	—	—	—	—	—	37	669
Faroos	—	—	—	180	—	231	—	—	390	32	—	—	86	919
Others	11	527	442	761	9	782	4	28	3	655	9,436	15	250	12,923
TOTAL IMPORTS	8,160	9,569	5,501	6,571	1,900	23,444	1,325	2,090	4,010	5,519	93,230	250	5,788	167,359

Sources: Trade Statistics(Various)

There may be some variation in figures as export figures given by a country may differ from import figures given by the recipient country.

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2. Outlook for Fresh Salmon Markets

World production of Norwegian pen farmed Atlantic salmon could reach 80,000 M.T. by 1990, and total world production could reach over 107,000 M.T. A more recent study by the Resource Policy Group, Oslo, Norway, shows a world market potential for Atlantic farmed salmon of 120,000 M.T. by 1990, of which 22,500 to 37,500 M.T. would be in the United States, (Table 13).

Table 13. Estimated Market Potential for Farmed Atlantic Salmon in 1990 (tonnes)

Country	- 25%	Potential	+ 25%
France	21,000	28,000	35,000
West Germany	16,500	22,000	27,500
U.K.	11,250	15,000	18,750
Rest of Europe	11,250	15,000	18,750
USA	22,500	30,000	37,500
Japan	7,500	10,000	12,500
TOTAL	90,000	120,000	150,000

Source: Resource Policy Group

Since 1980, imports of fresh, pen-raised Atlantic salmon have made inroads into the U.S. market. In 1981, U.S. imports from Norway of fresh Atlantic salmon were only 11 thousand pounds but in 1983, we imported close to 4 million pounds and in 1985, imports were close to 14 million pounds (Table 3). The rapid growth of Norwegian exports to the U.S. market has demonstrated that there is a significant consumer demand for fresh salmon in the U.S. market.

The outlook for increased consumption of Atlantic salmon in the United States is very good. Recent studies indicate that there are health benefits associated with the consumption of seafood especially in reduction of incidents of heart disease (Science News, Volme 28, October 1985). U.S. annual consumption of seafood has increased steadily in the past five years with a rise in per capita consumption from 12.8 pounds in 1980, to 14.5 pounds in 1985 (Table 14). Particularly significant in this trend has been the rise in per capita consumption of fresh and frozen from 8 pounds in 1980, to 9 pounds in 1985. Annual per capita consumption of fresh and frozen salmon has also increased rising from 0.47 pounds in 1981 to 0.85 pounds in 1985.

The amount of fresh product, although not separated from the fresh and frozen category is estimated to be about 30 to 40 percent of the total supply of fresh and frozen seafood, with a per capita consumption of 3 to 3.6 pounds in 1985. With consumer trends toward more natural foods and with wide international availability of fresh fish, we predict an increasing consumption of fresh seafood in future years.

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Table 14. U.S. Per Capita Consumption of Fish by Type 1961-1985

Year	Total U.S. Supply	Fresh & Frozen	Per Capita Consumption		
			Canned	Cured	Total
	Million Lbs.		Pounds		
1961	9,570	5.9	4.3	.5	10.7
1962	10,408	5.8	4.3	.5	10.6
1963	11,434	5.8	4.4	.5	10.7
1964	12,031	5.9	4.1	.5	10.5
1965	10,535	6.0	4.3	.5	10.8
1966	12,469	6.1	4.3	.5	10.9
1967	13,991	5.8	4.3	.5	10.6
1968	17,381	6.2	4.3	.5	11.0
1969	11,847	6.6	4.2	.4	11.2
1970	11,474	6.9	4.5	.4	11.8
1971	11,804	6.7	4.3	.5	11.5
1972	13,849	7.1	4.9	.5	12.5
1973	10,378	7.4	5.0	.4	12.8
1974	9,875	6.9	4.7	.5	12.1
1975	10,164	7.5	4.3	.4	12.2
1976	11,593	8.2	4.2	.5	12.9
1977	10,652	7.7	4.6	.4	12.7
1978	11,509	8.1	5.0	.3	13.4
1979	11,831	7.8	4.8	.4	13.0
1980	11,357	8.0	4.5	.3	12.8
1981	11,353	7.8	4.8	.3	12.9
1982	12,011	7.7	4.3	.3	12.3
1983	12,352	8.0	4.8	.3	13.1
1984	12,552	8.5	4.9	.3	13.7
1985	15,061	9.0	5.2	.3	14.5

Source: Fisheries of the United States

If past trends continue to be followed, we can expect per capita consumption of fresh and frozen to increase by .2 to .5 pounds per year. With an increase in U.S. population at present rate, we could expect a rise in U.S. population from 237 million people in 1985, to about 249 million people in 1990. An increase in consumption of fresh and frozen seafood at the past 5 year rate would result in a per capita consumption increase by 1 pound by 1990, bringing the total consumption for fresh and frozen from the 1985 level of 9 pounds per person to 10 pounds per person, or 2.49 billion pounds; an increase of 360 million pounds over the 1985 level of 2.13 billion pounds. At an increase in consumption of .5 pounds per person, which was the past two year trend, we could expect a consumption rise in fresh and frozen seafood to 11.5 pounds per person by 1990, with a total consumption of 2.86 billion pounds; an increase of 730 million pounds over the 1985 level of 2.13 billion pounds.

With a conservative estimate of 30 percent of fresh and frozen supply being marketed as fresh, we can expect an increase in supply of all fresh fish from 639 million pounds in 1985, to 747 million pounds in 1990, using the more conservative 5 year trend for fresh

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and frozen. If we use the past 2 year trend as a basis for projection, total U.S. consumption of all fresh seafood could reach 858 million pounds by 1990, an increase of 219 million pounds over the 1985 estimated consumption of 639 million pounds for all fresh seafood. If 40 percent of fresh and frozen seafood is marketed as fresh seafood, the total consumption for all fresh seafood could reach over a billion pounds by 1990. The following table shows the consumption for 1990:

Table 15. Projected U.S. Consumption of all fresh Seafood by 1990

Year	U.S. Population	Fresh and Per Capita Consump.	Frozen Total Consump. (mil/lb)	Consumption of Fresh Seafood (Million Lbs.)	
				1)	2)
1 9 8 5	237 million	9	2,130	639	852
1 9 9 0 ³⁾	249 million	10	2,490	747	996
1 9 9 0 ⁴⁾	249 million	11.5	2,860	858	1,144

1) At 30% of fresh and frozen

2) At 40% of fresh and frozen

3) At past 5 year trend

4) At past 2 year trend

3. Fresh Salmon Prices

The average import prices of fresh salmon have increased from \$1.97 per pound in 1982 to \$2.93 per pound in 1985. However, import prices of fresh salmon from Canada have declined steadily from \$2.58 per pound in 1981, to \$1.25 per pound in 1985, while

Table 16. Monthly Wholesale Prices of Fresh Atlantic (Norway) Salmon on New York Fulton Fish Market by Size (Dollars per Pound)

Year	Fish Size Pounds	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average*
1986	4-7	4.30	4.25	4.30	4.00									
	7-9	4.65	4.45	4.40	4.20									
	9-11	4.95	4.75	4.50	4.25									
	11-13	5.00	4.80	4.60	4.40									
1985	4-7	3.50	3.60	4.00	4.20	4.15	4.10	4.25	3.90	4.00	4.15	4.15	3.95	3.95
	7-9	4.20	4.10	4.15	4.75	4.60	4.40	4.65	4.20	4.55	4.55	4.65	4.65	4.65
	9-11	4.45	4.30	4.35	4.85	4.70	4.75	4.95	4.40	4.75	5.10	5.00	4.95	4.95
	11-13	4.60	4.55	4.50	5.15	4.80	4.90	5.10	4.60	4.90	5.20	5.20	5.10	5.10
1984	4-7	3.50	3.50	3.35	3.65	3.75	3.85	4.20	3.75	3.85	3.90	3.85	3.70	3.70
	7-9	4.05	3.90	3.60	4.05	4.10	4.15	4.45	4.30	4.50	4.30	4.25	4.20	4.20
	9-11	4.30	4.20	3.90	4.35	4.45	4.50	4.60	4.40	4.60	4.50	4.50	4.50	4.50
	11-13	4.50	4.35	4.20	4.75	4.70	4.65	4.70	4.65	4.70	4.80	4.75	4.75	4.75
1983	4-7	3.30	3.60	3.50	3.30	3.60	3.40	3.50	3.45	3.40	3.00	3.35	3.50	3.50
	7-9	4.25	4.05	4.00	4.00	3.90	4.10	4.15	3.85	4.15	4.00	4.00	4.00	4.00
	9-11	4.70	4.50	4.50	4.00	4.00	4.20	4.00	4.75	4.25	4.30	4.30	4.35	4.35
	11-13	4.90	4.70	4.80	4.50	4.30	4.60	4.40	5.00	4.50	4.50	4.50	4.55	4.55

*Weighted Averaged Prices

Source: National Marine Fisheries Service, New York Market News

수 산 경 영 문 집

Table 17. Annual Wholesale Prices of Fresh Salmon (Dollar per Pound)

Year	Fish Size-Pounds			
	4-7	7-9	9-11	11-13
1976	2.10	2.49	2.65	3.43
1977	2.12	2.59	2.69	3.70
1978	2.15	2.55	2.72	3.62
1979	2.47	2.93	3.13	4.35
1980	2.86	3.41	3.63	4.48
1981	3.50	4.16	4.44	4.49
1982	3.28	3.89	4.15	4.68
1983	3.50	4.00	4.35	4.55
1984	3.70	4.20	4.50	4.75
1985	3.95	4.65	4.95	5.10

Source: National Marine Fisheries Service, New York Market News and other sources

Table 18. U.S. Fresh Salmon Steaks Retail Prices Dollars Per Pound

	January	February	March	April	May	June	July	August	September	October	November	December
1973	.00	.00	.00	1.87	.00	2.24	.00	2.23	2.38	2.64	2.29	.00
1974	2.66	2.70	2.54	2.17	2.50	2.34	2.69	.64	.00	.00	.00	.00
1975	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1976	.00	.00	.00	.00	.00	3.27	3.25	2.79	2.93	3.38	3.32	3.55
1977	3.85	3.10	3.73	3.59	3.95	3.32	4.07	3.73	3.84	3.94	3.71	3.49
1978	3.59	3.64	3.08	3.77	4.25	3.36	3.77	4.36	4.11	4.48	4.24	4.02
1979	3.83	.00	.00	.00	4.16	3.86	4.74	4.74	3.54	.00	.00	4.32
1980	.00	.00	.00	4.98	5.00	4.48	3.40	5.49	4.57	4.14	4.72	3.91
1981	4.09	4.61	4.03	4.03	5.15	5.48	4.58	5.03	5.13	5.99	6.13	.00
1982	3.49	2.99	2.99	4.21	5.38	5.12	4.62	5.01	4.61	4.20	6.48	6.06
1983	4.39	4.39	3.34	3.05	3.05	3.05	3.77	4.15	4.26	3.68	4.03	.00
1984	.00	5.19	.00	5.32	5.16	5.47	5.46	5.47	5.69	5.05	5.36	.00
1985	5.19	4.99	5.99	.00	5.86	6.31	6.78	6.68	5.43	6.43	5.83	5.88

Source: Operation Price Watch, National Marine Fisheries Service

those from Norway remained unchanged, ranging from \$3.28 to \$3.45 over the 1981-85 period (Table 3).

The price of salmon per pound tends to be higher as the size of salmon increases (Table 16). Average wholesale price per pound of Norwegian fresh salmon was \$3.95 for 4-7 pound salmon; \$4.65 for 7-9 pound salmon; \$4.95 for 9-11 pound salmon; and \$5.10 for 11-13 pound salmon in 1985. Over the period of 1976-85, wholesale price of fresh salmon increased steadily from \$2.10-3.43 per pound to \$3.95-5.10 by fish size (Table 17).

Also, retail prices for fresh salmon steaks has increased steadily from about \$2.00 per pound in 1973, to \$6.00 per pound in 1985 (Table 18).

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IV. Demand Model for Fresh Salmon in U.S. Market

To measure price elasticities for fresh salmon in the U.S. market, a demand equation was estimated. The prices for fresh salmon in the United States are dependent on a number of factors in supply and demand functions. On the supply side, the U.S. catch and U.S. imports might have an influence on the price while demand will be shifted by fluctuations of the U.S. economy, which may be represented by changes in U.S. national income.

The demand function for fresh salmon in the United States is represented by the following:

$$P=f(C,L,I,Y)\dots\dots\dots(1)$$

where P: Price for fresh salmon

L: U.S. landings, King and Coho destined for fresh market

I: Imports of fresh salmon

Y: U.S. income

C: Constant

The demand equations were estimated by means of ordinary least squares with data for the period of 1976-1985 (10 observations). The input data for fresh salmon are prices in dollars per pound (Table 17), imports and landings in thousand pounds, and GNP in billion dollars (Table 19).

Table 19. U.S. Fresh Salmon Imports, Chinook and Coho Landings, and GNP 1976-1985

Year	Fresh Salmon Import Thousand Pounds	Chinook & Coho Landing	U.S. GNP Billion Dollars
1976	1,657	74,201	1,718
1977	1,207	62,667	1,918
1978	3,157	70,424	2,164
1979	217	62,775	2,418
1980	1,630	67,803	2,632
1981	1,839	56,281	2,958
1982	5,463	83,753	3,068
1983	8,197	87,089	3,304
1984	15,046	60,771	3,663
1985	19,274	55,087	4,112

The results are presented in the following table. Also, computer results are attached.

The regression equation for this model is specified (1). The dependent variables are annual wholesale prices of fish size. These price data are in current dollar and are

not adjusted by any price index.

Table 20. Estimated Coefficients for the Models by Fish Size 1976-85

Fish Size Pounds	Constant	I	L	Y	R ²
4-7	-0.07359	-0.00003 (0.000081)	0.000000 (0.000005)	0.001150 (0.000156)	0.96
7-9	0.084921	-0.00004 (0.000022)	-0.00000 (0.000006)	0.001358 (0.000182)	0.96
9-11	-0.04815	-0.00005 (0.000023)	-0.00000 (0.000006)	0.001465 (0.000192)	0.96
11-13	2.004419	-0.00004 (0.000023)	-0.00000 (0.000006)	0.000986 (0.000192)	0.94

(Standard errors in parentheses)

Independent Variables are as follows:

I = fresh salmon import in thousand pounds

L = U.S. landings of Chinook and Coho destined for fresh market in thousand pounds

Y = U.S. GNP in billion dollars.

The empirical results of the least square estimation process conform with a prior assumption. The signs of all the coefficients are consistent with prior expectations. The squared multiple correlation coefficients for all the models range .94-.96, which indicates an excellent "good fit" for demand equations estimates from time-series data. All the coefficients are significantly different from zero at $\alpha=0.05$.

As reported in the table, an increase in the fresh Atlantic salmon imports by a thousand pounds will decrease wholesale price by \$0.00003-0.00005 per pound by each fish size. That means an increase in the fresh salmon imports by a million pounds will decrease wholesale price by \$0.04 per pound averagely. While an increase in GNP by a billion dollars will increase wholesale prices by \$0.001-0.0015 per pound. That means an increase in GNP by a hundred billion dollars will increase wholesale prices by \$0.125 per pound averagely. However, domestic landing of Chinook and Coho would not influence on wholesale prices of fresh salmon.

To predict the wholesale price change of fresh salmon in 1990, we assume Norwegian production would be 80,000 M.T. (176 million pounds (Table 11) in 1990. Imports of Atlantic salmon from Norway are assumed to increase from 14 million pounds in 1985, to 37 million pounds in 1990 if the U.S. receives the same percentage (21%) of Norwegian productions in 1990, as it did in 1985. It is reasonable to also assume that U.S. Atlantic salmon imports from other countries and domestic productions would increase and maintain the same level of 25% of U.S. total supplies. These estimates could bring the total supplies in 1990 to as high as 50 million pounds with 31 million pounds increase over that in

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1985. We estimate that U.S. GNP would increase by \$ 200 billion annually, slightly less than the past years.

A total of 31 million pounds of additional supplies of fresh salmon would decrease wholesale price by \$ 1.24 per pound while the GNP increase of \$ 1,000 billion (\$ 200 billion × 5 years) would increase wholesale price by \$ 1.25 per pound. Therefore, wholesale price in 1990 would remain at the present level.

V. Summary and Conclusion

U.S. commercial landings of wild salmon have remained relatively stable for the past 5 years, averaging 300,000 MT. While the same period, U.S. imports of fresh salmon have increased over ten fold from 1.8 to over 19 million pounds.

Over 70 percent of the new supplies of fresh salmon come from Norway. Norway exports to the United States were negligible in 1980 and 1981. However, U.S. imported 1,768 M.T. in 1983, 3,896 M.T. in 1984, and 6,272 M.T. in 1985.

Over the past 5 years, import price of fresh wild salmon from Canada has declined steadily from \$ 2.58 per pound to \$ 1.25 per pound in 1985, while those from Norway had remained unchanged, ranging from \$ 3.28 to \$ 3.45 over the same period. Norway's cultured salmon entered the United States in 1985 at about \$ 3.35/lb., roughly triple the price of Canadian fresh wild salmon imports.

U.S. apparent consumption of fresh and frozen salmon has sharply increased from 50,000 MT in 1981 to 92,000 MT in 1985, up 86 percent over the five years. Annual per capita consumption has increased steadily from 0.47 pounds in 1981 to 0.85 pounds in 1985.

The estimated demand models show that the annual wholesale price of fresh salmon in the U.S. market would be declined by increase in supplies and would be raised by increase in the U.S. GNP.

The empirical results in this study show that wholesale price of fresh salmon in 1990 would remain unchanged at the 1985 level, under the following condition:

- 1) Norwegian production of Atlantic fresh salmon would reach 80,000 MT (176 million pounds by 1990)
- 2) Imports of Norwegian Atlantic fresh salmon would keep the same percentage (21%) of Norwegian productions in 1990
- 3) Imports from other countries and U.S. domestic production would increase and maintain the same level of 25% of U.S. total supplies in 1990
- 4) U.S. GNP would increase by \$ 200 billion annually, slightly less than in the past years.

美國의 연어 市場 價格 豫測에 관한 研究

김 대 겹

연어의 美國 養育은 過去 5年동안 平均 300,000톤으로 비교적 안정적이었다. 反面에 동 기간동안 美國의 연어 輸入은 1,800,000파운드에서 19,000,000파운드로 10배나 增加하여 왔다. 이러한 연어의 供給은 70%가 노르웨이에서 이루어졌다. 美國은 1981년까지는 노르웨이로부터 미미한 程度의 연어를 輸入하였지만, 1983년에는 1,768톤, 1984년에는 3,869톤 그리고 1985년에는 6,272톤을 輸入하였다.

카나다產 연어의 輸入價格은 過去 5年前에 \$2.58/1b에서 1985년에는 \$1.25/1b로 持續적으로 下落하여 왔으나, 反面 노르웨이產 연어의 輸入價格은 同一 期間동안 \$3.28/1b에서 \$3.45/1b까지 큰 變動없이 維持되어 왔다. 이와같은 노르웨이產 연어는 1985년에 約 \$3.35/1b로 카나다產 연어輸入價格의 約 3배에 달하는 것이다.

美國의 연어의 外形上 消費量은 1981년에 50,000톤이었으나 1985년에는 86%나 증가한 92,000톤으로 급격한 增加現象을 보이고 있다. 특히 每年의 1人當 消費는 1981년에 0.47파운드로부터 1985년에는 0.85파운드로 持續적으로 增加하고 있다.

以上과 같은 狀況을 基礎로 未來의 연어市場價格을 豫測하기 위하여 需要모델을 推定하였다. 推定된 需要모델에 의하면 美國市場에서의 每年의 연어 都賣價格은 供給의 增加에 의해서는 하락하지만 美國의 GNP增加에 의해서는 上昇할 것이라는 점을 나타내고 있다. 本 研究에 의한 結果는 美國의 總供給量이 25% 增加할지라도 美國의 GNP가 每年 \$200,000,000,000씩 增加할 때는 1990년의 연어 都賣價格은 1985年 水準으로 維持될 것이라는 點이다.