Alaska Sea Grant Program

An Investigation of Joint U.S./Foreign Ventures in the Developing Commercial Fishery in Alaska

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AN INVESTIGATION OF JOINT U. S./FOREIGN VENTURES IN THE DEVELOPING COMMERCIAL FISHERY IN ALASKA

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Final Report
to the
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Thanks are due to all the agencies and private industry concerns who provided information and guidance in the development of this report. The joint venture issue is a complex and controversial issue, and its debate will doubtless continue after this report is published. Any errors, midjudgments or latent biases in the writing of this report remain my own.

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EXECUTIVE SUMMARY

This report includes a systematic summary and economic analysis of seven joint venture proposals. It discusses the general conditions prevailing in the present market for groundfish and the investment decision-making process of the Gulf of Alaska groundfish industry. It provides a feasibility analysis of the harvesting and onshore processing of pollock and an examination of the costs and benefits of alternative development paths. An appendix introduces economic research needs as well as a supply response model which would be effective in determining investment response to alternative fishery policies as they apply to Alaska's groundfishery.

The conclusions and recommendations in this report are:

1. The present market outlook for development of onshore processing capability in pollock is highly favorable.

2. Supplying raw product to an offshore processor through a joint venture arrangement is presently the most viable alternative facing fishermen.

3. Neither of the major joint venture proposals (KMIDC/R.A. Davenny and Marine Resources, Inc.) contains a timetable for phase-out of foreign participation in the fishery.

4. An examination of gross benefits for the domestic harvesting and processing sectors under several alternative development paths indicates benefits for those sectors, greatest when joint ventures were gradually phased out.

5. In the absence of a definitive phase-out policy, some form of tax disincentive is recommended whereby foreign participation would become increasingly uneconomic with time.

This study results from a contract with the North Pacific Fishery Management Council to provide a systematic inquiry into

joint venture operations in order to meet the needs of the Council in assessing joint venture possibilities and proposals for the last half of 1978 and in the following years. The original objective was to research, define, and comment on the relative merits of commercial fishing joint ventures off Alaska and to recommend to the Council the disposition of various joint venture proposals.

This report has been limited to only research, definition, and comment on the various proposed joint ventures and to a discussion of management framework development. No specific recommendations have been made regarding the disposition of the various proposals. Recommendations based upon the data gathered in the study could only be made after the establishment of a final national policy regarding joint ventures and after the establishment of development of goals by the Council.

Every effort was made to search out and gather information on proposed joint ventures. All possible joint ventures may not be covered in this report, as some may still be in the corporate planning stages and not available for public review.

INTRODUCTION

The major issues involved in the management decision to allow or disallow a particular joint venture are embedded in the investment decision-making process of the private sector.

Investment Climate in Alaska Groundfishery

A firm contemplating investment in a heretofore underutilized fishery faces two broad categories of interrelated problems; (1) the conforming of investment decisions to the goals of federal fishery policy as invoked in the Fishery Conservation and Management Act (FCMA) and, (2) the broad problems of selecting the most economically efficient methods, capital, and knowhow to develop a viable enterprise. This latter category would also include problems associated with financing and interest rates, inflationary rates and risks specific to the fishery.

Preceding these two groups of interrelated problems, is the somewhat ethereal notion of defining the investment climate and the nature of entrepreneurship which, when combined effectively, will spawn a new industry.

With the advent of extended jurisdiction, the U.S. industry is now faced with the opportunity to expand its fishery in the Gulf of Alaska from a production (excluding halibut) of between 3 and 4 million pounds (1976 data) to one which could possibly harvest the entire optimum yield of 325.7 thousand MT. Added to this, is the potential harvest in the Bering Sea of 850 thousand MT. Taking advantage of this opportunity would produce in the vicinity of $300 to 400 million in revenue at the ex-vessel level, but it also requires extensive capital investment by private industry in harvesting/processing capability. The gap created between the time the rights of access were legislated and the time when domestic industry can fully utilize those rights of access, has brought forth a new type of business structure, the joint U.S./foreign venture.

The reasoning behind their formation is obvious. Foreign nations were looking for sources of supply. Domestic businessmen recognized the inefficiency involved with large-scale onshore processing of pollock. They saw a joint venture operation as a means of recognizing immediate gains from exploitation without the inherent delays of the normal investment process. The size of the capital outlay was smaller. The costs of operation were less, both from taking advantage of cheaper foreign labor on processing ships and from the seemingly inherent efficiency of at-sea processing for pollock. Sig Jaeger has suggested that the 15 minutes of time saved by delivering directly to a floating processor rather than bringing the catch onboard could bring in additional gross earnings of $80,000 annually (Jaeger, 1977). Certain state taxes would be avoided on processing, cold storage, and raw product. It was also a more risk-free alternative to gain expertise in the high volume, low value type of fishing operation which the pollock fishery represented and with which the U.S. had little previous experience.

From a federal policy viewpoint, the joint venture issue forced management officials to take a long look at the spirit and intent of the FCMA. Its legal underpinnings and its interaction with other policy goals were brought under close scrutiny. The controversy still rages.

At this juncture, it would appear useful to consider some of the more important issues which come into play in consideration of this extremely complex issue as it applies to the Gulf of Alaska bottomfishery.

Incentive

The immediate short-run cost involved in not allowing joint ventures in Alaska is foregone income at the harvesting level. Assume a joint venture plans to utilize five boats the first year, 10 boats the second year, and 15 boats the third year of operation. If we assume they can attract the crabber/trawler type vessel as described in the paper by Sig Jaeger (1977), the income foregone for the three-year period by not allowing the operation to proceed is $2,169,459 (undiscounted with multiplier effects ignored). Weighed against this figure is the possible beneficial effect on domestic business investment incentive if joint venture arrangements are not allowed. Though nonquantifiable,

this aspect of the investment process cannot be underestimated. Consideration of the cost of foregone income necessitates evaluation of incentive at both the harvesting and processing levels.

Harvesting Level Incentive

At the harvesting level, the incentive problem is caused by a combination of factors. The vessels most easily adaptable to bottomfishing are the large crabbers. They have the horsepower/winch combinations capable of producing large tows. If they are supplying onshore processing, they possess refrigerated sea water equipment to keep the catch fresh; a prime factor in handling pollock. The incentive problem arises because both crab and shrimp are high valued species and the industry, particularly crab, is undergoing tremendous expansion. Fishermen established in a highly lucrative and still expanding fishery are somewhat reluctant to engage in a fishery of a totally different nature, i.e., high volume, low value, in which they have little expertise, and for which they must make capital outlays of up to $250,000 for trawl gear.

There is an additional aspect to the harvesting level incentive problem. Fishermen are reluctant to show enthusiasm for joint ventures as they often supply fish to processors who are very much opposed to the joint venture concept. The risk of losing an established relationship with a processor is viewed as a very real possibility should a fisherman become vocal in his support of a joint venture.

Many of the smaller vessels, more inclined to show interest in the developing bottomfishery, face substantial costs for refrigeration equipment and gear if they are to supply onshore processing (up to $500,000). These costs, they are understandably reluctant to undertake in what they feel to be a high risk venture at present. The Alaska Fisheries Development Corporation, now funded, will undoubtedly do much to mitigate the risk involved for this group of fishermen.

Joint venture operations are no less affected by the incentive problem at the harvesting level. It was felt the joint venture processing type operation provided the fishermen an alternative to the high cost of installing refrigeration equipment. Supplying a floater processor at sea does not require the use of refrigeration equipment. At present, the pervasive attitude

of fishermen with regard to joint ventures is one of "wait and see." The only semi-firm commitments by fishermen appear to be from Kodiak shrimp fishermen who had a poor shrimp harvest in 1978. For all these reasons, foregone income figures based on crabber/trawler earnings are probably overstated.

Processing Level Incentive

To a large extent, the incentive problem at the processing level has been interrelated with federal policy consideration of joint ventures. Federal management policy associated with extended jurisdiction is evolving simultaneously with investment decision-making in the processing industry. This simultaneity has had a marked effect on investment incentive, and may in fact be a significant determining factor in the business structure of the mature industry. An example of this problem has been the reluctance of U.S. processing to commit investment funds to develop domestic bottomfish processing capability. Conversely, the North Pacific Fishery Management Council has been looking for indications of intent to develop domestic processing capability to help them formulate policy with regard to allowance of joint ventures. This whole process has evolved into a chicken-egg problem whose outcome has little to do with developing a U.S. fishery in a biologically and economically efficient manner. If the present interim policy becomes final, processing capability of U.S. concerns will not be a factor in management decisions.

GROUNDFISH MARKET PERSPECTIVE

Before specific joint venture projects are reviewed and analysed, it may be useful to place the Gulf of Alaska groundfishery in a worldwide perspective and examine trends in domestic utilization of groundfish products. Since the joint venture issue is predominantly one of the harvest of pollock and its incidental catch, this aspect of the overall Gulf groundfishery will be focused upon.

Gulf of Alaska Groundfishery - A Worldwide Perspective

From Tables A and B it can be seen that, as of 1976, Japan and the U.S.S.R. combined, harvested and consumed 52 percent of world landings and consumption of groundfish. The four world export leaders of groundfish blocks and slabs (1976), in order, are Norway, Canada, Iceland, and Denmark (Table C). Norway alone totals 37 percent of the total world export market for groundfish. The United States imports 99.4 percent (Table C) of its groundfish blocks and slabs primarily from these four countries. In terms of volume exported to the U.S., Iceland is the leader, followed by Canada, Denmark, and Norway (Table D). Of the 364 million pounds of imported regular blocks and slabs, 26 percent is pollock, with cod being the dominant leader (1976). The minced blocks and slabs added another 14.5 million pounds to the import volume, but these were not broken down by species.

If the pollock block imports alone are examined (Table E), it is found the four largest exporters to the U.S. in order of importance are Korea, Japan, Iceland, and Norway. Korea supplied 61 percent to the total imports of pollock blocks.

Notice from this analysis that, as of 1976, the countries involved in the Gulf of Alaska groundfishery were not the same as those supplying the major bulk of total U.S. imports. Since that time, several events have occurred which may bear on future world market structure. Both the U.S. and the U.S.S.R. have declared 200-mile limit zones. On the east coast of the United States, the major foreign countries to suffer were the U.S.S.R. and

TABLE A

WORLD GROUNDFISH LANDINGS BY COUNTRY, 1950-76
(Round weight)

Year	Canada	Denmark	France	Iceland	Japan	Norway	United Kingdom[1]	United States	USSR	West Germany	Total of all Countries	Other	Total
						million pounds							
1950	798	207	230	564	555	651	1,355	715	725	503	6,303	1,362	7,665
1951	779	216	236	608	684	755	1,487	800	801	577	6,923	1,421	8,344
1952	796	222	264	641	802	747	1,492	720	940	601	7,225	1,512	8,737
1953	764	204	263	615	904	711	1,446	600	926	591	7,024	1,422	8,446
1954	907	236	296	723	945	669	1,439	676	1,524	585	8,000	1,394	9,394
1955	897	247	361	765	930	778	1,544	655	1,840	719	8,736	1,709	10,445
1956	1,002	223	360	736	980	924	1,559	651	2,027	753	9,215	1,658	10,873
1957	963	286	351	675	1,169	817	1,469	651	1,467	663	8,511	1,794	10,205
1958	852	261	382	845	1,225	863	1,474	649	1,607	623	8,781	1,611	10,392
1959	951	318	407	809	1,628	879	1,411	633	1,859	640	9,535	1,525	11,060
1960	949	314	415	783	2,179	811	1,343	637	2,376	674	10,481	1,697	12,178
1961	932	422	674	785	2,272	1,195	1,510	636	2,518	845	11,789	2,763	14,552
1962	1,028	376	679	718	2,352	1,121	1,612	657	2,669	885	12,097	3,029	15,126
1963	1,038	493	672	779	1,974	1,170	1,579	635	2,957	871	12,168	3,341	15,509
1964	1,153	605	746	875	2,537	1,142	1,593	615	3,131	831	13,228	3,176	16,404
1965	1,238	560	781	801	2,551	1,265	1,701	608	4,163	907	14,575	3,551	18,126
1966	1,343	595	822	710	2,897	1,346	1,668	600	4,535	885	15,401	2,907	19,308
1967	1,285	527	781	687	4,148	1,281	1,666	513	5,322	958	17,168	3,967	21,135
1968	1,368	678	809	770	4,931	1,278	1,727	490	5,603	951	18,605	4,259	22,864
1969	1,315	1,417	692	940	5,608	1,466	1,724	445	5,938	859	20,414	3,781	24,195
1970	1,233	995	719	991	6,414	1,544	1,724	424	6,098	764	20,906	3,772	24,678
1971	1,239	1,136	692	901	7,275	1,966	1,680	406	7,152	768	23,215	4,418	27,633
1972	1,151	1,362	675	819	8,128	1,947	1,586	407	7,691	663	24,429	4,756	29,185
1973	1,192	1,224	693	835	8,259	1,840	1,554	405	8,453	682	25,137	5,110	30,247
1974	926	1,931	702	894	7,750	2,012	1,472	381	9,256	766	26,090	5,431	31,521
1975	939	1,322	627	922	7,222	2,001	1,334	409	9,236	638	24,650	5,309	29,959
1976	1,040	1,705	679	1,011	6,767	2,002	1,330	407	9,236	699	24,876	5,795	30,671

Source: 1950-69; Based on available data from FAO Yearbook of Fisheries Statistics, various years (the list of specific species included as groundfish for 1950-69 was unavailable.)

1970-76, FAO Yearbook of Fishery Statistics, Volume 40, 1975 for years 1970 through 1975, Volume 42, 1976 for year 1976.

Included all species of Table B-31 except halibut
Included all species of Table B-32
Species included from Table B-33: Atlantic Redfish
All Rockfishes
Pacific Ocean Perch
Lingod
Sablefish

[1]United Kingdom = England-Wales; Scotland; and Northern Ireland.

TABLE B

WORLD CONSUMPTION OF GROUNDFISH BY COUNTRY, 1950-76[1]

(Round weight)

Numbers are millions of pounds

Year	Canada	Denmark	France	Iceland	Japan	Norway
1950	[2]	[2]	[2]	[2]	555.0	[2]
1951	[2]	[2]	[2]	[2]	684.0	[2]
1952	[2]	[2]	[2]	[2]	802.0	[2]
1953	130.0	81.3	48.2	281.9	904.0	202.1
1954	187.9	152.6	108.4	211.9	945.0	138.9
1955	140.7	257.5	102.2	352.4	930.0	141.5
1956	234.5	200.3	141.0	245.1	980.0	162.6
1957	169.5	256.7	145.0	225.5	1,169.0	178.6
1958	152.4	244.4	199.5	174.0	1,225.0	181.8
1959	152.1	140.9	227.8	97.3	1,628.0	146.0
1960	164.5	161.2	244.9	129.4	2,179.0	58.8
1961	207.8	221.6	504.6	255.4	2,272.0	418.1
1962	221.4	159.5	525.6	181.5	2,352.0	297.5
1963	186.8	191.3	572.6	288.1	1,974.0	227.3
1964	232.2	318.3	648.3	301.7	2,537.0	326.4
1965	309.4	191.6	703.8	221.1	2,551.0	375.1
1966	395.1	210.9	732.8	190.4	2,897.0	341.0
1967	327.2	158.6	698.6	265.9	4,148.0	203.2
1968	491.1	309.1[3]	702.4	385.6	4,931.0	425.3
1969	343.3	1,092.8[3]	621.3	377.4	5,611.6	168.1
1970	284.4	651.0[3]	692.9	379.1	6,414.0	167.2
1971	277.2	674.3[3]	796.3	468.6	7,275.0	424.7
1972	295.3	822.1[3]	878.4	400.2	8,128.0	411.0
1973	311.4	733.9[3]	822.7	758.3	8,259.0	617.2
1974	277.1	1,490.3[3]	777.5	469.6	7,750.0	914.5
1975	271.5	860.1[3]	683.0	352.2	7,222.0	655.1
1976	285.9	1,154.2[3]	728.7	448.9	6,520.0	685.6

TABLE B

WORLD CONSUMPTION OF GROUNDFISH BY COUNTRY, 1950-76[1] (continued)

(Round weight)

Numbers are millions of pounds

Year	United Kingdom	United States	USSR	West Germany	Other	Total
1950	[2]	931.5	725.0	[2]	[2]	7,665.0
1951	[2]	1,051.5	801.0	[2]	[2]	8,344.0
1952	[2]	1,010.8	940.0	[2]	[2]	8,737.0
1953	1,500.1	934.3	974.5	600.2	2,789.4	8,446.0
1954	1,505.9	1,051.2	1,606.2	594.9	2,891.1	9,394.0
1955	1,570.5	1,126.2	1,935.5	726.7	3,161.8	10,445.0
1956	1,606.2	1,080.0	1,213.3	767.1	4,242.0	10,873.0
1957	1,536.5	1,203.3	1,595.0	674.2	3,051.6	10,205.0
1958	1,542.7	1,114.3	1,805.8	568.8	2,969.4	10,392.0
1959	1,490.0	1,263.4	2,083.6	593.6	3,237.3	11,060.0
1960	1,492.4	1,229.7	2,589.7	582.4	3,346.0	12,178.0
1961	1,738.0	1,367.7	2,576.7	675.8	4,314.3	14,552.0
1962	1,778.8	1,430.1	2,797.0	808.2	4,576.4	15,126.0
1963	1,718.5	1,454.0	3,079.1	789.0	5,028.3	15,509.0
1964	1,829.5	1,536.3	3,297.7	727.8	4,648.8	16,406.0
1965	1,972.6	1,647.1	4,292.1	857.9	5,004.3	18,126.0
1966	1,825.3	1,713.0	4,670.5	831.9	5,500.1	19,308.0
1967	1,873.0	1,604.2	5,496.5	913.0	5,446.8	21,135.0
1968	1,916.3	1,894.6	5,683.3	811.5	5,313.8	22,864.0
1969	1,984.6	2,027.9	6,023.6	806.5	5,127.9	24,195.0
1970	2,050.4	2,204.0	6,189.0	761.3	4,884.7	24,678.0
1971	1,904.8	1,905.5	7,199.0	817.4	5,890.2	27,633.0
1972	1,660.6	1,820.6	7,737.9	668.6	6,362.3	29,185.0
1973	1,760.5	1,588.0	8,453.0	700.1	6,242.9	30,247.0
1974	1,679.6	1,461.5	9,332.1	827.5	6,541.3	31,521.0
1975	1,578.5	1,794.2	9,339.1	688.5	6,514.8	29,959.0
1976	1,599.0	1,992.6	9,294.2	733.6	7,228.3	30,671.0

[1]Consumption was calculated using export and import data from Table D.

[2]Not available.

[3]Does not include the Faeroe Islands.

TABLE C

WORLD GROUNDFISH LANDINGS, INTERNATIONAL TRADE, AND CONSUMPTION, 1970-1976

(Round weight)

Numbers are millions of pounds

Year		Canada	Denmark	France	Iceland	Japan	Norway	United Kingdom	United States	USSR	West Germany	Total of Countries	Other Countries	Total
1970	Landings	1,233.0	995.0	719.0	991.0	6,414.0	1,544.0	1,724.0	424.0	6,098.0	764.0	20,906.0	3,772.0	24,678.0
	Imports	.8	13.7	74.6	--	--	8.0	363.0	1,781.4	91.0	47.9	2,380.4	2,412.4	4,792.8
	Exports	949.4	357.7	100.7	611.9	--	1,384.8	36.6	1.4	--	50.6	3,493.1	1,299.7	4,792.8
	Consumption	284.4	651.0	692.9	379.1	6,414.0	167.2	2,050.4	2,204.0	6,189.0	761.3	19,793.3	4,884.7	24,678.0
1971	Landings	1,239.0	1,136.0	692.0	901.0	7,275.0	1,966.0	1,680.0	406.0	7,152.0	768.0	23,215.0	4,418.0	27,633.0
	Imports	--	--	162.2	--	--	14.3	256.0	1,500.5	47.0	71.5	2,051.5	2,097.1	4,148.6
	Exports	961.8	461.7	57.9	432.4	--	1,555.6	31.2	1.0	--	22.1	3,523.7	624.9	4,148.6
	Consumption	277.2	674.3	796.3	468.6	7,275.0	424.7	1,904.8	1,905.5	7,199.0	817.4	21,742.8	5,890.2	27,633.0
1972	Landings	1,151.0	1,362.0	675.0	819.0	8,128.0	1,947.0	1,586.0	407.0	7,691.0	663.0	24,429.0	4,756.0	29,185.0
	Imports	--	0.8	203.4	--	--	16.5	104.7	1,414.6	46.9	66.1	1,853.0	2,772.9	4,125.9
	Exports	855.7	540.7	--	418.8	--	1,552.5	30.1	1.0	--	60.5	3,459.3	666.6	4,125.9
	Consumption	295.3	822.1	878.4	400.2	8,128.0	411.0	1,660.6	1,820.6	7,737.9	668.6	22,822.7	6,362.3	29,185.0
1973	Landings	1,192.0	1,224.0	693.0	835.0	8,259.0	1,840.0	1,554.0	405.0	8,453.0	682.0	25,137.0	5,110.0	30,247.0
	Imports	--	1.5	129.7	--	--	26.1	219.4	1,184.8	--	37.9	1,599.4	1,744.8	3,344.2
	Exports	880.6	491.6	--	76.7	--	1,248.9	12.9	1.8	--	19.8	2,732.3	611.9	3,344.2
	Consumption	311.4	733.9	822.7	758.3	8,259.0	617.2	1,760.5	1,588.0	8,453.0	700.1	24,004.1	6,242.9	30,247.0
1974	Landings	926.0	1,931.0	702.0	894.0	7,750.0	2,012.0	1,472.0	381.0	9,256.0	766.0	26,090.0	5,431.0	31,521.0
	Imports	--	2.3	108.0	--	--	32.5	216.5	1,082.0	76.1	75.4	1,592.8	1,499.0	3,091.8
	Exports	648.9	443.0	32.5	424.4	--	1,130.0	8.9	1.5	--	13.9	2,703.1	388.7	3,091.8
	Consumption	277.1	1,490.3	777.5	469.6	7,750.0	914.5	1,679.6	1,461.5	9,332.1	827.5	24,979.7	6,541.3	31,521.0
1975	Landings	939.0	1,322.0	627.0	922.0	7,222.0	2,001.0	1,334.0	409.0	9,236.0	638.0	24,650.0	5,309.0	29,959.0
	Imports	--	1.5	94.3	--	--	13.8	246.8	1,388.0	103.1	68.0	1,915.5	1,573.3	3,488.8
	Exports	667.5	463.4	38.3	569.8	--	1,359.7	2.3	2.8	--	17.5	3,121.3	367.5	3,488.8
	Consumption	271.5	860.1	683.0	352.2	7,222.0	655.1	1,578.5	1,794.2	9,339.1	688.5	23,444.2	6,514.8	29,959.0
1976	Landings	1,040.0	1,705.0	679.0	1,011.0	6,767.0	2,002.0	1,330.0	407.0	9,236.0	699.0	24,876.0	5,795.0	30,671.0
	Imports	--	--	111.2	--	--	4.1	274.2	1,589.5	58.2	73.5	2,110.7	1,664.0	3,774.7
	Exports	754.1	550.8	61.5	562.1	247.0	1,320.5	5.2	3.9	--	38.9	3,544.0	230.7	3,774.7
	Consumption	285.9	1,154.2	728.7	448.9	6,520.0	685.6	1,599.0	1,992.6	9,294.2	733.6	23,442.7	7,228.3	30,671.0

Source: 1950-70, FAO Yearbook of Fishery Statistics and Fishery Statistics of the United States, various years.
1971-76, FAO Yearbook of Fishery Statistics, various years; included appropriate imports and exports from Tables B3-1,3,4,6, and C3-1,2,7 from "Fishery Commodities" volumes.

Note: Factors used to convert from product weight to round weight were:

1950-1970:

Cod, fresh or frozen X 1.17
Flatfish, saithe, fillets, fresh or frozen X 2.85
Cod, fillets, steaks, fresh or frozen X 3.08
Blocks X 3.55
Ocean perch X 3.33
Cod skinned or boned X 4.50 (pickled or salted)
Cod dried X 4.88
Cod whole, beheaded, smoked or kippered X 1.50
Cod fillets, steaks, smoked or kippered X 3.40

1971-1976:

Fresh or frozen:
Cod, etc. X 1.17
all blocks X 3.55
Fillets or steaks:
Cod X 3.08
Flounder X 2.82
Haddock, Hake, Pollock, Cusk, etc. X 2.85
Ocean perch X 3.33

Cured:
Dried:
Cod, etc X 4.88
Unclassified X 3.00
Salted:
Cod, etc:
Skinned or boned X 4.50
Other X 3.50
Unclassified: X 1.50
Smoked or kippered:
Cod, etc:
Whole, beheaded, etc. X 1.50
Fillets, steaks, etc. X 3.40

TABLE D

FOREIGN TRADE

U.S. IMPORTS

IMPORTS OF REGULAR AND MINCED FISH BLOCKS AND SLABS, BY SPECIES AND TYPE, 1975 AND 1976

Species and type	1975		1976	
	Thousand pounds	Thousand dollars	Thousand pounds	Thousand dollars
Regular blocks and slabs:				
Cod	160,857	83,963	180,126	117,027
Flatfish:				
Turbot	2,776	1,214	8,514	5,210
Other	10,025	6,837	13,164	11,365
Haddock	36,649	19,730	28,547	18,712
Ocean perch, Atlantic	2,173	1,007	7,981	5,046
Pollock	74,831	20,907	95,699	35,315
Whiting	8,727	2,696	20,570	8,288
Other	7,553	3,331	9,636	6,038
Total	303,591	139,685	364,237	207,001
Minced blocks and slabs (1)	9,888	2,072	14,505	4,120
Grand total	313,479	141,757	378,742	211,121

(1) Most of the shipments were from Canada, Denmark, and Japan.
Source:--U.S. Department of Commerce, Bureau of the Census.

IMPORTS OF REGULAR AND MINCED FISH BLOCKS AND SLABS, BY COUNTRY OF ORIGIN, 1975 AND 1976

Country	1975		1976	
	Thousand pounds	Thousand dollars	Thousand pounds	Thousand dollars
Iceland	54,286	25,565	67,272	41,682
Canada	42,311	21,493	50,920	33,561
Denmark	39,589	19,466	48,803	30,960
Norway	61,142	33,133	46,348	26,048
Korea, Republic of	37,125	9,375	59,741	20,235
Japan	25,365	9,639	26,113	15,232
Federal Republic of Germany	10,706	5,424	19,949	11,986
Poland	7,955	3,528	14,186	7,254
Other	35,000	14,134	45,410	24,163
Total	313,479	141,757	378,742	211,121

Source:--U.S. Department of Commerce, Bureau of the Census.

IMPORTS OF GROUNDFISH FILLETS AND STEAKS, BY SPECIES, 1975 AND 1976 (1)

Species	1975		1976	
	Thousand pounds	Thousand dollars	Thousand pounds	Thousand dollars
Cod	91,017	70,770	118,447	102,419
Haddock (2)	41,747	28,150	49,494	38,470
Ocean perch, Atlantic	67,592	37,723	60,346	46,578
Total	200,356	136,643	228,287	187,467

(1) Does not include data on fish blocks and slabs.
(2) Includes some quantities of cusk, hake, and pollock fillets.
Source:--U.S. Department of Commerce, Bureau of the Census.

TABLE E. U. S. Imports of Pollock Blocks, by Country of Origin, 1974-1976 (Product Weight).

(million pounds)

Country of Origin	1974	1975	1976
Republic of Korea	14.8	36.7	58.6
Japan	47.0	15.5	10.5
Iceland	6.9	10.9	10.2
Norway	1.6	3.8	5.1
Denmark	5.3	3.1	5.0
Poland	-	0.2	2.0
Federal Republic of Germany	1/	0.1	1.9
Canada	1.1	2.8	1.2
United Kingdom	3.3	1.3	0.8
Other	0.1	0.4	0.4
TOTAL	80.1	74.8	95.7

1/ Less than 50,000 pounds.

Source: U. S. Department of Commerce, Bureau of the Census.

Poland. Japan and Korea were the major countries to suffer from the extended jurisdiction zone declared by the U.S.S.R. This clearly explains why the U.S.S.R. and Korea are now looking to the Gulf of Alaska as an alternative source of supply. None of these countries are among the top suppliers of groundfish blocks and slabs (all species included) to the U.S., however, Korea is the major supplier of pollock blocks.

How have the catches on the Gulf of Alaska historically ranked in the world supply picture? Again, based on 1976 figures from Tables A and B, the Soviet Union landed 4,190,562.6 MT (round weight) of groundfish. Of that, 427,000 MT came from the Gulf of Alaska, or ten percent of the total. Japan landed in the same year a total of 3,070,326.7 MT, of which 1,304,000 MT or 42 percent came from the Gulf of Alaska. South Korea landed 445,600 MT of pollock (International Fisheries Analysis Division), of which 117,000 MT or 26 percent of the total landings came from Alaskan waters (80 percent of the catch in Alaskan waters came from the Eastern Bering Sea and Aleutian Islands). Note that, since 1976, both Japan and Korea have been excluded from U.S.S.R. fishing grounds so that greater dependence on Alaskan waters for groundfish catches now exists for these two countries. The extent to which the Soviet Union will make up its losses in catch from the east coast of the U.S. in its own waters is difficult to determine, but their interest in a joint venture in Alaska provides some indication. Clearly, the greatest risk, if any, of world market instability and its subsequent effects on the American consumer lies in the degree of dependence the U.S.S.R., Korea, and Japan now place in the Gulf of Alaska for their groundfish supplies. The Soviet Union and Japan, as stated previously, are the world's leading producers and consumers, and Korea is the major supplier of pollock blocks to the U.S.

Trends in Domestic Utilization of Groundfish Products[1]

Groundfish are generally consumed as fillets, sticks, or portions. Cod, flounder, turbot, ocean perch, and haddock are the usual fillet product species. Pollock is used primarily in the sticks and portions product forms along with cod, haddock, and whiting. Consumption of sticks and portions increased 14 percent between 1975 and 1976 to 438 million pounds; 340 million

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1 Source: NOAA, NMFS, C.E.A. F-28.

pounds of this total were in the form of portions, and 75 percent of the portions went to restaurants (fast-food chains) and institutions. Sticks are primarily sold in retail food chains.

In 1977, the tremendous growth in the sticks and portions market leveled off, but consumption maintained itself despite record high prices for sticks and portions. There was, however, a substantial increase in overall inventories of blocks, the raw material for production of sticks and portions (Tables G and H). The inventory for pollock alone, however, was down.

The overall inventory buildup in 1977 is attributed to a combination of heavy imports and lower usage of blocks. Third-quarter usage of cod blocks fell about 33 percent, and usage of pollock blocks fell 25 percent.

Portion production in 1977 increased three percent over 1976 figures. This corresponds to increases in restaurant sales of 10.5 percent above 1976 with restaurant price increases of 7.6 percent. One explanation for the slower growth of portion consumption compared to the previous year is the record wholesale prices of cod. Production of fish sticks in 1977 was off seven percent. Switches in demand to lower-priced sticks may have prevented further declines. The price of cod sticks was up 22 percent in the fourth quarter of 1977, a 22 percent increase over the previous year. Pollock sticks were up 25 percent in price, and whiting stick prices were up six percent (Table H). The outlook for 1978 for fish sticks and portions as seen by the Industry and Consumer Services Division of NMFS is reproduced here for convenience.

Outlook

Sales of fish sticks and portions are likely to be slightly greater than year-earlier levels in the first half of 1978. The continued growth in sales of battered sticks and portions indicates market strength both at retail and in the food service trade. In addition, major fast food chains have pursued a policy for growth by adding new units, and this growth will require additional supplies. On the opposite side, the higher prices

TABLE F
CATCHES (APPROXIMATE) OF BOTTOMFISH OFF ALASKA BY COUNTRY AND INPFC AREAS 1970-77

	United States	Canada	USSR	Japan	South Korea	Poland	Taiwan	Total	Area Distribution Percent	U.S. as Percent Total
1970			(1,000 metric tons, round weight)							
Bering Sea, Aleutian	*	1	232	1.480	5	------	------	1.718	93.5	*
Shumagin	1	1	2	8	------	------	------	12	0.7	8.3
Chirikof	2	4	2	9	------	------	------	17	0.9	11.8
Kodiak	6	2	5	20	------	------	------	33	1.8	16.2
Yakutat	1	2	*	21	------	------	------	24	1.3	4.2
Southeastern	5	1	---	27	------	------	------	33	1.8	15.2
TOTAL	15	11	241[a]	1.565	5	------	------	1.837	100.0	0.8
PERCENT	0.8	0.6	13.1	85.2	0.3	------	------	100.0		
1971										
Bering Sea, Aleutian	*	*	397	1.806	10	------	------	2.213	94.1	*
Shumagin	1	1	8	10	------	------	------	20	0.8	5.0
Chirikof	2	3	5	8	------	------	------	18	0.8	11.1
Kodiak	5	3	17	23	------	------	------	48	2.0	10.4
Yakutat	1	2	1	23	------	------	------	27	1.1	3.7
Southeastern	4	1	---	24	------	------	------	29	1.2	13.8
TOTAL	13	10	428[a]	1.894	10	------	------	2.355	100.0	0.6
PERCENT	0.6	0.4	18.2	80.4	0.4	------	------	100.0		
1972										
Bering Sea, Aleutian	*	*	412	1.917	9	------	------	2.338	92.0	*
Shumagin	1	1	17	16	1	------	------	36	1.4	2.8
Chirikof	1	3	12	7	------	------	------	23	0.9	4.3
Kodiak	5	2	37	26	------	------	------	70	2.8	7.1
Yakutat	1	2	3	30	------	------	------	36	1.4	2.8
Southeastern	4	1	---	33	------	------	------	38	1.5	10.5
TOTAL	12	9	481[a]	2.029	10[b]	------	------	2.541	100.0	0.5
PERCENT	0.5	0.4	18.9	79.8	0.4	------	------	100.0		

TABLE F (continued)
CATCHES (APPROXIMATE) OF BOTTOMFISH OFF ALASKA BY COUNTRY AND INPFC AREAS 1970-77

	United States	Canada	USSR	Japan	South Korea	Poland	Taiwan	Total	Area Distribution Percent	U.S. as Percent Total
1973				(1,000 metric tons round weight)						
Bering Sea, Aleutian	*	*	340	1,755	7	*	-------	2,110	91.5	*
Shumagin	1	*	14	10	3	-------	-------	28	1.2	3.6
Chirikof	1	1	16	15	------	-------	-------	33	1.4	3.0
Kodiak	4	2	28	25	------	*	-------	59	2.6	6.8
Yakutat	1	1	4	35	------	-------	-------	41	1.8	2.4
Southeastern	4	1	---	29	1	-------	-------	35	1.5	11.4
TOTAL	11	5	410	1,869	11[b]	*	-------	2,306	100.0	0.5
PERCENT	0.5	0.2	17.8	81.0	0.5	*	-------	100.0		
1974										
Bering Sea, Aleutian	1	*	436	1,574	34	-------	*	2,045	91.5	*
Shumagin	*	*	20	12	3	-------	*	35	1.6	*
Chirikof	1	*	8	15	------	-------	-------	24	1.1	2.9
Kodiak	2	*	46	31	------	*	-------	79	3.5	2.5
Yakutat	1	1	3	19	------	-------	-------	24	1.1	4.2
Southeastern	3	1	---	19	3	-------	-------	26	1.2	11.5
TOTAL	8	2	513	1,670[c]	40[b]	*	*	2,233	100.0	0.4
PERCENT	0.4	0.1	23.0	74.8	1.8	*	*	100.0		
1975 (preliminary)										
Bering Sea, Aleutian	*	*	334	1,254	8	-------	3	1,599	84.9	*
Gulf of Alaska	10	2	134	124	10	4	-------	284	15.1	3.5
TOTAL	10	2	468	1,378	18	4	3	1,883	100.0	0.5
PERCENT	0.5	0.1	24.9	73.2	1.0	0.2	0.1	100.0		

TABLE F (continued)
CATCHES (APPROXIMATE) OF BOTTOMFISH OFF ALASKA BY COUNTRY AND INPFC AREAS 1970-77

	United States	Canada	USSR	Japan	South Korea	Poland	Taiwan	Total	Area Distribution Percent	U.S. as Percent Total
1976 (preliminary and incomplete)										
Bering Sea, Aleutian	*	*	320	1.199	94	------	2	1.615	86.8	*
Gulf of Alaska	8	2	107	105	23	------	------	245	13.2	3.3
TOTAL	8	2	427	1.304	117	------	2	1.860	100.0	0.4
PERCENT	0.4	0.1	23.0	70.2	6.3	------	0.1	100.0		
1977 (total allowable catch - NPFMC)										
Bering Sea, Aleutian	*	*	251	1.032	43	5	10	1.341	82.9	*
Gulf of Alaska	17	2	108	105	38	7	------	277	17.1	6.1
TOTAL	17	2	359	1.137	81	13	10	1.618	100.0	1.1
PERCENT	1.1	0.1	22.2	70.2	5.0	0.8	0.6	100.0		

*Less than 500 tons or 0.05%
a) Sources give U.S.S.R. catch for "Gulf of Alaska" only. Allocation to INPF areas calculated on basis of 1973 and 1974 distributions.
b) Sources give South Korea catch for "Gulf of Alaska" only. Allocation to INPF areas calculated on basis of fleet movements reported by NMFS Law Enforcement Branch.
c) "Gulf of Alaska" catch by Japan by INPF areas 96 thousand metric tons as compared with 112 thousand metric tons as reported by species.

Sources: Rogers, George W., Development of an Alaskan Bottomfish Industry and State Taxes, A report to the Legislative Affairs Agency and the House Interim Resources Committee, Institute of Social and Economic Research, University of Alaska.

1970-1975: International North Pacific Fisheries Commission, Vancouver, B.C.
--Statistical Yearbook (annual).
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--Yearbook of Fisheries Statistics (annual)

NMFS, Law Enforcement Branch
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Alaska Department of Fish and Game, Juneau
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North Pacific Fisheries Management Council, Anchorage
--Management Plan for the Groundfish and Herring
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--Management Plan for the Groundfish Fisheries of the Gulf of Alaska, 1977
--Report of the Halibut Working Group, August 16, 1977

1976: Ikuo Ikeda, "1978 allowable catches for the Ground Fishes in the Bering Sea and Gulf of Alaska," Far Seas Fisheries Research Laboratory, Japan. July 1977. (Includes statistics on Japan and USSR fisheries not elsewhere published at this date).

"Foreign Fishing Operations off Alaska, March 1976 and 1977." NMFS Law Enforcement Branch, March 15, 1977 (contains tables summarizing estimated 1976 catch and 1977 allocations for USSR, Japan and Korea based on observers' reports and other sources).

1977: "Foreign Fishing Allocations off Alaska by Countries" NMFS, Alaska Region, March 3, 1977 (single table summarizing allocations for total Bering Sea/Aleutians and Gulf of Alaska by country and species).

Data included in the above and following tables can only be taken as approximations of probable catchs actually made. Basic sources of published data do not appear always to be reliable and principal documents consulted differed in a number of specific instances (som significantly). Halibut catch reported in dressed weight adjusted to estimated round weight by author. 1975 and 1976 data in part estimated by author from incomplete source data.

TABLE G

Supply and utilization of fish sticks and portions, January-December 1976-77

Component	1976	1977	Change
	-Million pounds-		-Percent-
Beginning inventory	35.3	31.1	- 12
Production			
Sticks	93.4	87.0	- 7
Portions	340.1	350.8	+ 3
Total	433.5	437.8	+ 1
Imports	.6	.6	-
Total supply	469.4	469.4	-
Ending inventory	31.1	30.5	- 2
Apparent consumption	438.3	438.9	-

Inventory of fish blocks on December 31, 1976-77, by species

Species	1976	1977	Change
	-Million pounds-		-Percent-
Cod	14.5	36.5	+ 152
Flounder	4.7	2.8	- 40
Haddock	2.4	8.0	+ 233
Pollock	15.7	11.1	- 29
Whiting	5.6	3.3	- 41
Minced	7.9	4.7	- 41
Other	10.2	6.8	- 33
Total	61.1	73.2	+ 20

Supply and utilization of fish blocks, January-December 1976-77

Component	1976	1977	Change
	-Million pounds-		-Percent-
Beginning inventory	79.0	61.1	- 23
Production	2.7	4.6	+ 70
Imports	378.7	385.1	+ 2
Total supply	460.4	450.8	- 2
Ending inventory	61.1	73.2	+ 20
Disappearance	399.3	377.6	- 5

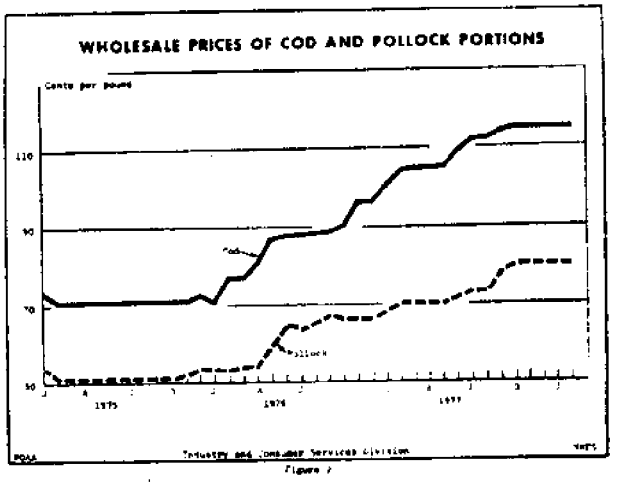

TABLE H

.--Wholesale prices for fish sticks and portions, monthly, 1975-77

Month	Sticks, cooked				Portions, raw breaded			
	Cod	Haddock	Pollock	Whiting	Cod	Haddock	Pollock	Whiting
	Cents per pound							
1975								
January	75.3	75.8	56.3	55.0	73.6	74.3	53.4	51.0
February	72.5	73.0	53.3	55.0	71.0	71.5	51.0	51.0
March	72.5	73.0	53.3	55.0	71.0	71.5	51.0	51.0
April	72.5	73.0	53.3	55.0	71.0	71.2	51.0	51.0
May	72.5	73.0	53.3	55.0	71.0	71.0	51.0	51.0
June	72.5	73.0	53.3	55.0	71.0	71.0	51.0	51.0
July	72.5	73.0	53.3	55.0	71.0	71.0	51.0	51.0
August	72.5	73.0	53.3	55.0	71.0	71.0	51.0	51.0
September	72.5	73.0	53.3	55.0	71.0	71.0	51.0	51.0
October	72.5	73.0	53.3	55.0	71.0	71.0	51.0	51.0
November	72.3	74.5	53.8	55.0	71.0	71.8	52.0	51.0
December	73.3	75.3	54.2	61.4	72.4	72.5	53.0	54.0
Average	72.8	73.6	53.7	55.5	71.3	71.6	51.5	51.3
1976								
January	73.3	75.3	54.0	62.0	71.0	72.5	53.0	54.0
February	74.4	76.0	54.5	61.8	72.5	74.1	53.3	55.8
March	78.4	79.2	57.2	61.2	76.8	79.0	54.0	61.0
April	79.0	80.0	58.0	61.0	76.8	79.0	54.0	61.0
May	83.2	84.7	62.3	62.3	81.9	85.3	59.0	61.0
June	87.3	89.3	66.5	63.0	87.0	91.5	64.0	1/
July	89.1	90.8	66.4	69.7	88.0	91.5	63.7	67.5
August	90.0	91.8	66.3	73.0	88.5	91.5	65.5	67.5
September	88.8	92.5	67.2	73.0	88.5	91.5	66.9	68.7
October	90.0	94.6	67.4	72.3	90.6	93.0	66.4	68.5
November	96.0	99.3	66.0	70.0	97.0	97.5	66.0	65.5
December	96.0	99.3	66.0	70.0	97.0	97.5	66.0	65.5
Average	85.5	87.7	62.7	66.6	84.6	87.0	61.0	63.3
1977								
January	98.0	101.2	68.3	71.5	100.8	101.5	68.0	67.5
February	100.0	103.0	70.5	73.0	104.5	105.5	70.0	69.5
March	106.5	110.5	70.9	70.5	105.0	108.0	70.0	69.0
April	106.5	110.5	71.0	70.5	105.0	108.0	70.0	69.0
May	106.5	110.5	71.0	70.5	105.0	108.0	70.0	69.0
June	108.0	110.8	72.5	70.9	109.5	111.3	71.8	70.2
July	109.0	111.0	73.5	72.5	112.5	113.5	73.0	71.0
August	109.0	111.0	73.5	72.5	112.5	113.5	73.0	71.0
September	115.0	115.5	80.3	73.6	114.8	116.9	78.3	71.0
October	117.0	117.0	82.5	74.0	115.5	118.0	80.0	71.0
November	117.0	117.0	82.5	74.0	115.5	118.0	80.0	71.0
December	117.0	117.0	82.5	74.0	115.5	118.0	80.0	71.0
Average	109.1	111.3	74.9	72.3	109.7	111.7	73.7	70.3

1/ Insufficient quotes.

Note: Prices to primary wholesalers as quoted by producers at Boston, Gloucester, and New Bedford.
Source: Fishery Market News Report, National Marine Fisheries Service, Boston, Mass.

have led to increased competition with meat and poultry products. Also, some hamburger chains desiring to add fish to their menus have had problems in maintaining sales of fish, and some new units specializing in fish have not been able to show a profit and many have been discontinued.

Prices of sticks and portions are expected to be generally stable in the first half of 1978. The large inventory of blocks at the beginning of 1978 and imports should be sufficient to provide the needs of producers of sticks and portions. Holdings of blocks on January 1, 1978, were 73 million pounds, 20 percent above stocks on hand a year earlier.

The record high prices of sticks and portions are expected to be less of a damper on sales in the first half of 1978 than in 1977 because of anticipated increases in prices of beef. The U.S. Department of Agriculture believes that beef production will drop 2 to 5 percent, primarily because of lower supplies of grass-fed cattle. This could lead to an increase of 16 percent or more in the price of hamburger in 1978, and should aid sales of sticks and portions. Increases in prices of grain-fed beef are anticipated to be about six percent. However, pork prices are likely to fall substantially in 1978 because of increased production. The price of broilers is also expected to be lower, because of larger production and lower feed costs.

Implications and Further Analysis

The general forecast for sticks and portions appears strong, but the dynamic growth in markets of earlier years appears to be leveling off.

Bockstael (1976) in a demand study of the New England Groundfishery, found price elasticities of groundfish products to be extremely high, indicating that U.S. consumers would quickly switch to other protein sources, should groundfish prices rise. Martin (1978) has observed that the portion market may, in fact, be less price elastic than the stick market, since the portion market is essentially restaurant oriented, and the stick market is retail supermarket oriented. This information, combined with the NMFS forecast, has several implications for potential

domestic onshore processing operations for pollock and U.S. consumers.

First, since the wholesale prices of cod and pollock are high, prospects for onshore processing with its associated higher costs (than offshore operations) of operation are becoming more and more feasible. Since cod prices are relatively higher than pollock prices, shifts in the stick market to the lower-priced alternatives to cod (i.e., pollock and whiting) may continue and could possible grow. This would create an expanded domestic demand for Alaska pollock. Further, since beef prices are expected to rise in 1978, consumer retaliation against high fish stick prices may be mitigated to some extent.

What are the implications for the American consumer arising from increased demands placed on the Gulf of Alaska groundfishery from the Soviet Union, Korea, and Japan? Prices of groundfish in various areas worldwide do not show a high degree of correlation. Thus, a high groundfish price in the Soviet Union or Japan may not be reflected in European prices, for example.

There is a high correlation of prices among European countries, and Europe as a block is the second largest importer of groundfish next to the U.S. This would suggest price variation occurs due to lags in market adjustment or to the fact that a large importer, such as the U.S., may exert a certain amount of market power. This would indicate that any instability in groundfish market, if it did occur, would least likely be felt in the U.S.

Secondly, and relatedly, the U.S. does not depend on the U.S.S.R., Japan, or Korea for its major supplies of groundfish blocks and slabs. If substitution of pollock for cod in fish sticks occurs on a large scale due to their relative prices, this may change in the future. But it must still be kept in mind that the optimum yield for all species of groundfish in the Gulf of Alaska is only 326,000 MT. The combined total catches of Japan, Korea, and the Soviet Union are in the vicinity of eight million MT. The market share of this total, the entire optimum yield that the Gulf of Alaska would represent, is only four percent.

PROPOSED JOINT VENTURES

Information on specific joint venture plans has been acquired from various sources. Voluminous material exists for the two main joint venture projects, the Korea Marine Industry Development Corporation/R. A. Davenny and Associates (hereafter referred to as KMIDC); and Bellingham Cold Storage Co./Soviet Ministry of Fisheries and Sovrybflottl (hereafter referred to as Marine Resources). This information was acquired through personal contact with these companies and from public testimony and prepared legal statements. Rumor, letters of inquiry written to the North Pacific Fishery Management Council office (NPFMC) by various persons interested in pursuing joint venture plans, and phone contacts have led to a limited amount of information on five other proposed joint venture plans. In many cases, the plans are still quite nebulous. This is due largely to organizational and financing problems typical of infant concerns and uncentainty stemming from lags in federal policy formulation. Summaries of all seven projects appear on the following pages.

Korea Marine Industry Development Corporation/R. A. Davenny and Associates

The target species for this operation is pollock, with an average expected incidental catch of 15 percent, largely of species more valuable than pollock.[2] The original plan for cost efficient operation was for three processing vessels to process 130,000 MT of pollock and bycatch over an approximate 10-month period. The present application is for one stern trawler (factory ship), one factory ship (processing), and a transport vessel. Initially, five catcher boats will supply one of the processors. The second processor will be used as a transport vessel until such time as operations expand. Off-bottom trawls with zippered cod-ends will be utilized on the catcher vessels.

Each processor requires 200 MT of raw material per day for efficient operation. This would require each of five catcher boats to deliver in the vicinity of 40 MT of fish per day for 325 days/year.

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2 Pacific Ocean Perch, Rockfish, Pacific Cod, and Flounders.

The products from this type of operation include finished fillet blocks; whole headed-gutted, frozen in the round fish; blocks of minced flesh; and fish meal.

Only that portion of production which equals in value the amount paid out to domestic (U.S.) fishermen will be marketed in the U.S. directly. This is to mitigate any balance of trade problems in Korea. The rest of the product will be transported to Korea.

If an when permits are obtained, a domestic (U.S.) corporation will be chartered. Stock will be issued according to authorized capital input; up to 50 percent to R. A. Davenny and Associates, up to 30 percent to the Korea Marine Industry Development Corporation, and up to 20 percent to other investors.

Korea Marine Industry Development Corporation will purchase fish from the domestic corporation using an irrevocable revolving letter of credit. The annual per ton price will be negotiated each year and a minimum balance on the letter of credit will be established at $3 million.

Fishermen will be paid upon presentation of verified copies of fish tickets. During the first year of operation, fishermen will receive 5¢ per pound plus 1/2¢ per pound at the end of the year's fishing season. No price incentive will be offered for incidental species. An additional 1/2¢ per pound will be paid at the end of the fifth year of fishing, provided the fisherman has fished for the corporation throughout the five-year period. "The second year price will be 5¢ per pound plus 10 percent of the use in the U.S. market price per pound for pollock fillets during the first year of operation plus the year-end and five year-end 1/2¢ bonuses."[3]

Plans for financial help to fishermen for gear, vessel acquisition, and vessel improvement have not been solidified, nor are there intentions to do so until a corporation is actually formed.

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[3] From the Summary of the Agreement between Korea Marine Industry Development Corporation and R. A. Davenny & Associates, Inc.

Bellingham Cold Storage Co./Soviet Ministry of Fisheries and Sovrybflottl, A Soviet Commercial Fisheries Organization

Bellingham Cold Storage Co. and Sovrybflottl, a Soviet commercial fisheries organization have formed a joint (50/50) corporation known as the U.S.-U.S.S.R. Marine Resources Co., Inc.

Target species for the firm in the Gulf of Alaska is pollock with expected incidental catch of up to 20 percent.

Their desired tonnage is 75,000 MT to be processed by the floating processor vessel, Sulak. Maximum processing efficiency requires 10 catcher vessels to supply the floater with approximately 25 MT per day per vessel for a 300-day processing year.

For the remaining months of July through December, 1978, Marine Resources proposes an experimental fishing operation using five U.S. flag vessels to supply the Sulak with approximately 10,000 MT of fish to be caught in the Shirikof and Shumagin areas of the Gulf of Alaska. Zippered cod-end nets will be used for stern chute delivery aboard the Sulak.

Offered price to fishermen is 6¢ per pound with compensation for incidental catch still to be determined.

The product forms for this operation will be finished fillet blocks; whole headed-gutted, frozen in the round fish; frozen ground-up scrap; and fish meal. Reprocessing will occur in Japan for pollock roe and the fillet blocks will be reprocessed into a battered or breaded form in the U.S. The fillet blocks will be sold in the U.S. and on the world markets. The fish meal will go into animal feed and the scrap will be used for pet food. No specific market for these two products was identified.

Mrs. Paul's Kitchens Inc./Polish Fishing Fleet

Mrs. Paul's Kitchens, Inc., is proposing a joint venture with the Polish fleet (hereafter referred to as Mrs. Paul's) in which the Poles would harvest and process 60,000 MT of pollock to be processed into frozen blocks; reprocessing and sale to be

entirely in the U.S. Mrs. Paul's Kitchens, Inc. is to receive 51 percent of the control and return for the proposed venture.

The number of floating processors to be utilized depends on actual allocation as does the number of Polish catcher vessels to be used to supply them. Efficiency requires a catch rate of 60 MT per day for each catcher vessel. Services of all Polish vessels would be obtained on a lease arrangement.

Edward E. Head - Ellis, Sund & Whittaker, Inc./Japan and/or Korea

Management thrust for this joint venture is centered in Ketchikan. The target species would be black cod. Essentially, this group desires to buy or lease Korean or Japanese long-line freezer ships and operate them with Korean crews. Subsequent attempts to integrate American crews for training purposes would be initiated.

American vessels would be utilized to bring a portion of the catch ashore for processing in Ketchikan. An additional American vessel may be contracted with to provide additional black cod catch to the onshore processing facility. Completion of processing and cold storage facilities in Ketchikan are envisioned in three to five years.

The fishery would encompass the area from the Canadian border to the vicinity of Yakutat and grow and develop markets for its products as the fishery recovers. It is hoped this operation would fill an employment gap being created by a declining pulp industry.

Bering Sea Herring/Korea

In 1977, the Korean government requested permission for its ships to engage in the loading, freezing, and transporting of herring and herring roe on kelp from ports in western Alaska. The Department of Commerce issued permits for transportation only. Many processors are involved in the transportation system in the general area of Togiak. Under the 1977 permits, two

Korean vessels bought herring and herring roe on kelp. In 1978, the operation has expanded to 11 Japanese and Korean vessels.

The herring is gutted and salted ashore and chilled on the purchasing ship. The herring roe is packed in brine in five-gallon buckets. Ten to eleven thousand tons of herring will be taken in the general Togiak area in 1978. Close to 5,000 MT have been taken to date. About 95 percent of the herring in the area is involved in this "system." An industry representative in Togiak feels the high quality of herring in the area may provide potential for entering the European market.

Indian Fishermen in Angoon, Alaska/Japan

Japanses interests are proposing to tie up a processing vessel at Angoon, in Southeast Alaska, to receive salmon from Native (Indian) fishermen. The salmon would be headed and gutted at the U.S. onshore processing facility and transferred to the Japanese vessel at ambient temperature, where it would be frozen and stored for ultimate sale in the U.S. market.

The preceding paragraph appeared in a paper for use in National Marine Fisheries Service hearings on joint ventures. Attempts to collect additional information regarding this proposed venture have been unsucessful.

Other

Mr. Richard Wilson, representing an Alaska Native corporation, contacted the Alaska Sea Grant Program to discuss possible joint venture plans for bottomfishing. Onshore processing is one of the considerations in their plan. Not additional information is available.

JOINT VENTURE ANALYSIS

As can be surmised from the summary statements, only three of the joint venture projects have plans sufficiently formulated to comment on in terms of product, income, and employment benefits to the U.S. or in terms of the credibility of the plans themselves. Therefore, the discussion which follows will center on the KMIDC, Marine Resources, and Mrs. Paul's projects. These projects will be analysed using the following six criteria:

1. operational efficiency,
2. product destination, i.e., who benefits,
3. degree of U.S. (domestic) labor utilization,
4. evidence in plans of eventual U.S. (domestic) takeover of present foreign phases of operation,
5. percentage of corporate returns accruing to the U.S. (domestically), and
6. bycatch utilization and price differentials to fishermen.

Operational Efficiency

Among the three proposals, there is a wide discrepancy in expected per-day catch rates of the harvesting vessels. Mrs. Paul's is the only venture that can predict its per-boat catch rate with any certainty based on prior performance. Without knowing vessel sizes and capabilities of gear and crew, both KMIDC and Marine Resources can only guess at per-day catch rates. The Marine Resources' estimate of 25 MT/day/vessel is the more conservative approach of the two. Given the experimental nature of the ventures, neither Marine Resources nor KMIDC are expected to operate initially at full efficiency capacity. Mrs. Paul's venture is probably the only alternative which would harvest and process their total proposed allocation with full certainty. Overall operational efficiency of plans which intend use of domestic (U.S.) fishing boats for raw product supply is extremely

difficult to comment upon given the lack of experimental trials thus far.

Product Destination

KMIDC plans to market in the U.S. and in Korea with a revenue ceiling on its sales to the U.S. equaling ex-vessel revenues paid out to U.S. fishermen. Product intended for delivery to Korea will reportedly be utilized by Koreans. However, Korea has a large export trade in pollock with Japan and the U.S.

The entire catch of the Mrs. Paul's venture will be marketed in the form of frozen blocks in the U.S. Poland is the eighth largest exporter to the U.S. of frozen pollock blocks and slabs. The U.S. imported a total of 385,138,000 pounds of blocks and slabs from various countries in 1977. If Poland provides an additional 60,000 MT or 132,240,000 pounds in 1978, added to the 10,792,000 pounds of 1977, she would capture 37 percent of the U.S. blocks and slabs import market provided other countries maintained their 1977 export figures in 1978. This would represent a substantial improvement in her competitive status in the market for frozen blocks and slabs.

No specific product destination has been identified in the Marine Resources venture and product destination will depend upon world market conditions.

Labor Utilization

Prediction of domestic (U.S.) labor utilization for each concern requires knowledge of particular quota allocations actually granted, bycatch utilization, if any, estimates of catcher boat efficiency in supplying the intended floaters and the extent of reprocessing which will occur in the U.S.

It is obvious, the optimum yield for pollock in the Gulf of Alaska is not large enough to give all concerned their maximum allocation requests. A few operations (possibly only one) operating at peak efficiency is preferable to many joint ventures operating under marginal conditions with meager quotas. However, if the present interim policy becomes final, there would appear to be little leverage allowed for regulation in this area.

Harvesting Employment

Clearly, if KMIDC is granted permission, it plans the largest operation in terms of requested tonnage (130,000 MT). This operation would utilize ten harvesting vessels which if a crew size of four is assumed, would employ 40 fishermen. The Marine Resources concern was formed to take advantage also of the under-utilized hake resource. Their plans, with regard to pollock in the long-run, are quite probably intimately related to what happens with their harvesting plans for hake. Should they harvest and process their full requested quota for pollock, employment for 40 fishermen would be provided, again based on an assumed vessel crew size of four. Mrs. Paul's plans no usage of domestic harvesting capacity and would thus have no effect on U.S. harvesting employment.

Processing Employment

The only proposed U.S. employment in processing is in terms of bycatch utilization. KMIDC has no present plans for shore delivery of bycatch for onshore processing. Marine Resources has apparently left the issue open for further discussion. It is suspected all three parties would be open to suggestion to some degree on bycatch utilization and conservation measures if it meant the difference between obtaining and not obtaining a quota allocation.

Reprocessing Employment

Potential for employment generation from reprocessing in the U.S. is greatest in Mrs. Paul's venture. This must, however, be weighed against the fact that no regional harvesting employment would be created by this venture. In the KMIDC venture, reprocessing potential within the U.S. will always be directly tied to the amount of revenue paid out in the harvesting sector. Marine Resources' domestic (U.S.) reprocessing potential will, according to their plans, depend on year-to-year market conditions.

Domestic Takeover

Among the three major joint venture plans under discussion, there is no evidence of plans for eventual domestic (U.S.) takeover

of the foreign phases of operation. At this stage in their development, even looking for that evidence is hopelessly premature. Some interesting observations surface, however, when some of the smaller joint venture projects are examined in this regard.

The herring transportation scheme has been of obvious benefit to domestic (U.S.) concerns. They are producing high quality products for demanding markets and the expertise gained is causing them to eye potential markets in Europe.

The black cod project in Ketchikan started from a specific objective; to replace declining employment in the pulp industry. They plan onshore processing and cold storage facilities and eventual takeover of onboard processing capability; all job-creating goals.

These smaller, more modest operations originating from specific needs of small communities may not in the immediate future meet the requirements of harvesting and processing a large tonnage fishery such as the bottomfishery for pollock in the Gulf of Alaska. The larger concerns who do have the expertise and capital to harvest and process a large tonnage fishery, and the management authorities who will guide them would, however, benefit greatly from observation of their planning procedure. They are utilizing foreign expertise to maximum advantage to develop a fishery structure which is essentially domestic and will eventually be able to function autonomously. It is difficult to envision any of the larger joint venture plans under discussion accomplishing these goals in a predictable manner.

Corporate Returns

Determining domestic (U.S.) corporate returns and ranking the three large joint ventures in this way is difficult without having a specific quota to go by. Mrs. Paul's Kitchens, Inc. would accrue 51 percent of corporate returns on 60,000 MT of fish if permission is granted to fish her entire quota request. Bellingham Cold Storage Co. would get 50 percent on 75,000 MT of fish and depending on stock ownership, R. A. Davenny and Associates and other U.S. investors could accrue "up to" 70 percent on 130,000 MT of fish.

Bycatch Utilization and Price

The employment effects of bycatch utilization have been discussed previously. Marine Resources is the only concern indicating any possibility of a price differential being paid to fishermen for incidental species of higher value than pollock.

OPERATIONAL DEVELOPMENT AND COST EFFICIENCY OF DOMESTIC HARVESTING AND PROCESSING OF GROUNDFISH

Which type of operating mode is actually the most efficient for bottomfishing in Alaska? Should domestic capital be funneled into onshore processing? Does foreign offshore processing represent the most efficient route or should Americans be looking toward phase-out of foreign participation and development of a combination of onshore and domestically owned offshore capability? The second part of the question asks, if joint venture operations are not allowed, what will the structure of a totally domestic industry be like? Will it eventually develop to its full potential?

Given the species diversity in the Gulf of Alaska, it is difficult to point to a single method of operational development and state it to be the "best" and most cost efficient.

For species such as pollock, the so called "high volume, low value" species, the history of development by foreign nations has been one of progressing to larger and larger floating operations. These large fleets require tremendous volumes of fish to be operationally cost efficient. This requires pulse fishing on a worldwide scale to avoid severe depletion of stocks in any one area. Before the scramble by countries to declare exclusive fishing zones contiguous to their coasts, this type of worldwide migration was possible. In many cases, the impetus for declaring an exclusive zone was severe depletion of stocks of fish by foreign nationals.

Countries with large-scale fishing fleets are finding themselves severely limited by quotas worldwide, and in many cases, excluded from some fishing zones entirely. This situation is putting increasing economic strain on the large factory ship fleets. Many are already in mothballs. In fact, recent studies have shown the mid-size stern trawler to be the most cost-efficient vessel given the present jurisdictional and stock conditions worldwide.

From the foreign point of view, a joint venture in the Gulf of Alaska represents a chance to keep factory ships economically

operational for a few more years. Some, it has been admitted, are losing money already. In some instances, it has become a question of losing some money and staying in operation, or losing a lot and going into mothballs.

The lesson for the United States' development of a bottom-fishery, perhaps, is that joint ventures would provide harvesting employment in the short-run situation, but this should be weighed against dependence on an industry structure that could possibly become outmoded. Joint venture allowance would be dangerous if it is precluding development of alternative methods of harvesting and processing, perhaps ones more suited to the present economic, legal, and marketing climate. Knowledge of exactly what those alternative methods are, and how they can be adapted to different species' product forms and markets is presently in a primitive stage of development. Particularly in the harvesting sector, domestic industry representatives agree that there is a great lack of information in the area of methods, costs, and markets. There has been, however, a feasibility study of onshore processing completed at Oregon State University (Martin, 1978). The study was based on information provided under the provisions of a contract between Icicle Seafoods, Inc., Petersburg, Alaska, and the Alaska Department of Commerce and Economic Development. The results of that study and their implications for joint venture policy will now be discussed.

Feasibility of Onshore Processing of Groundfish in Alaska

As indicated, the research by Martin was a case study of Icicle Seafoods, Inc. At the time the work began, it was the only firm in Alaska processing pollock. Recognition is given in the study to the fact that the results based on analysis of only one firm are to simply indicate "order-of-magnitude estimates of the expected costs and returns to other seafood processors in Southeast Alaska entering pollock production."

Martin begins by reviewing critical sources of uncertainty facing the processor of pollock in Southeast Alaska. He found supply variability to be the major source of uncertainty followed in importance by pollock markets, new technology, and the institutional environment. In a review of the biological aspects of resource availability as it relates to the potential support of a commercial fishery, he found that based on existing information, no definitive statement could be made on the ability of the pollock resource in Southeast Alaska to support a commercial fishery. He specifically identifies the availability of the

resource during the winter months as the prime source of uncertainty in the economic feasibility of pollock processing.

In the actual processing feasibility segments of the study, distributions of the break-even pollock block prices under various production, cost, and discount rate assumptions are generated. Martin found that the current market price exceeded the break-even block prices under all sets of assumptions and concludes pollock processing is indeed economically feasible.

"Pollock processing in S.E. Alaska appears to be economically feasible under all sets of assumptions evaluated. The December, 1977, wholesale price of frozen Alaska pollock blocks, as quoted in the Market News Report, Boston, Mass. is 68.0¢/pound. The break-even wholesale pollock block prices, for the mixed production analysis, are 48.6, 55.1, and 61.6¢/pound, for the low-range cost assumption uses the ex-vessel prices currently paid to fishermen in Petersburg as the basis of the variable cost calculations. The implication is that even if the processing costs are understated via the estimates, pollock processing is still economically feasible at the current level of ex-vessel prices.

As indicated in Table I, there has been considerable variation in wholesale pollock block prices over the past four years. Given this variability in price, the decision to use the current wholesale price of 68¢/ pound for feasibility determination may appear unwarranted, and the conclusion that pollock processing is economically feasible too strongly stated. However, the decision to use a wholesale block price of 68¢/pound is based upon the following justifications. First, the worldwide extension of coastal nation's jurisdiction to 200 miles vitally affects the two main suppliers of Alaska pollock blocks to the U.S. As detailed in the next chapter, both Japan and Korea face severe reductions in the allowable harvest of pollock from waters of the U.S.S.R. Since the U.S.S.R. does not export fisheries products to the U.S., the expected effect of these quota restrictions will be to help maintain wholesale prices of Alaska pollock blocks at the current record levels. Secondly, the wholesale price of cod blocks, one of the main substitutes for pollock blocks, is also at record levels. Cod block prices will probably not fall appreciably in upcoming years, due to severe quota restrictions on all fleets in the North Atlantic, precipitated by the biologically depressed state of cod stocks in that area. Finally, the increasing demand for fish portions by fast-food enterprises should also serve to maintain all fish block prices at their current levels.

Table 1. Wholesale prices of Alaska pollock frozen fish blocks, monthly, 1974-1977.

Month	1974	1975	1976	1977
January	52.8	31.0	35.6	49.0
February	51.8	31.8	36.0	48.6
March	50.3	34.5	37.5	49.5
April	48.5	34.5	38.4	1/
May	45.4	33.6	39.5	59.5
June	43.7	32.7	42.0	60.2
July	40.5	33.0	43.4	65.0
August	40.0	33.9	46.8	67.0
September	39.5	34.6	49.0	68.0
October	37.3	35.5	48.9	66.0
November	36.0	35.7	49.0	67.0
December	1/	36.2	49.0	68.0
Average	44.2	33.9	43.0	60.7

1/ Insufficient quotes.

Note: Prices to processors as quoted by producers, importers, and brokers at Boston, Gloucester, and New Bedford.

Source: Fishery Market News Reports, National Marine Fisheries Service, Boston, Massacusetts.

This analysis indicates that in order for the break-even block price to equal the current market price, ex-vessel prices of 6¢/pound for fish without roe and 8¢/pound for fish with roe would have to be paid to the fishermen.

The NPV equation is solved for the level of $_b$ at which the net present value of the investment equals zero under a given set of assumptions. Therefore the break-even wholesale block price becomes the dependent variable in the model, derived for given levels of the independent variables. Several of the independent variables are assumed constant in this model at the levels listed in Table J.

TABLE J. Values of the independent variables which are held constant throughout the pollock processing feasibility analysis.

Independent Variable	Constant Value
Proportion of pollock suitable for filleting	70%
Yield on blocks	22%
Variable costs of processing blocks exclusive of raw product	6.68¢/pound of raw product
Proportion of pollock suitable for headed and gutted production	30%
Yield on headed and gutted	56¢
Variable costs of processing headed, and gutted, without roe, exclusive of raw product	6.55¢/pound of raw product
Pollock roe price	$1.00/pound
Roe yield	3%
Variable costs of processing headed and gutted, with roe, exclusive of raw product	7.54¢/pound of raw product
Capital outlay requires	$131,750.00

The volumes of production during the ten years, the discount rate, and ex-vessel prices are allowed to vary in the analysis. Volume distributions are determined via the triangular distribution and Monte Carlo simulation methods. Varying the discount rate has little effect on the break-even block price. However, there is a direct relationship between the ex-vessel pollock prices and the break-even block price. This is depicted graphically for mixed production in Figure 1.

The sensitivity of the break-even wholesale block price to variable costs under all sets of assumptions needs to be underscored. The implication for the pollock processor is that there exist very strong incentives to achieve increases in efficiency through the processing operation. This can be achieved by either reducing the labor costs/pound of raw product or by increasing the yield on blocks or headed and gutted pollock. Either measure would lower the break-even pollock block price. It is also evident that the capital costs incurred to establish a pollock processing line are relatively small compared to the variable costs of production over the ten-year investment horizon.

The institutional environment in which a pollock processor must make decisions is a source of uncertainty. Two issues are of particular importance to processors interested in groundfish development in Alaska. The first is whether or not foreign joint ventures are allowed by the North Pacific Fisheries Management Council and the Department of Commerce to operate in Alaska. Should joint ventures be authorized to purchase pollock from U.S. fishermen, the exvessel pollock price may be bid upward. This research indicates that higher ex-vessel prices increases the break-even wholesale block price, everything else remaining equal. The second item of interest to a pollock processor is the level of government involvement in fisheries development. If government or joint industry-government sponsored commercial fishing trials materialize, some of the uncertainty regarding supply availability may be reduced.[4]

Feasibility of Domestic Harvesting of Pollock

Harvesting of pollock in the Gulf of Alaska utilizes the mid-water otter trawl. This gear requires a vessel with a minimum engine capacity of 500 horsepower. In addition, weather in the

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[4] Martin (1978).

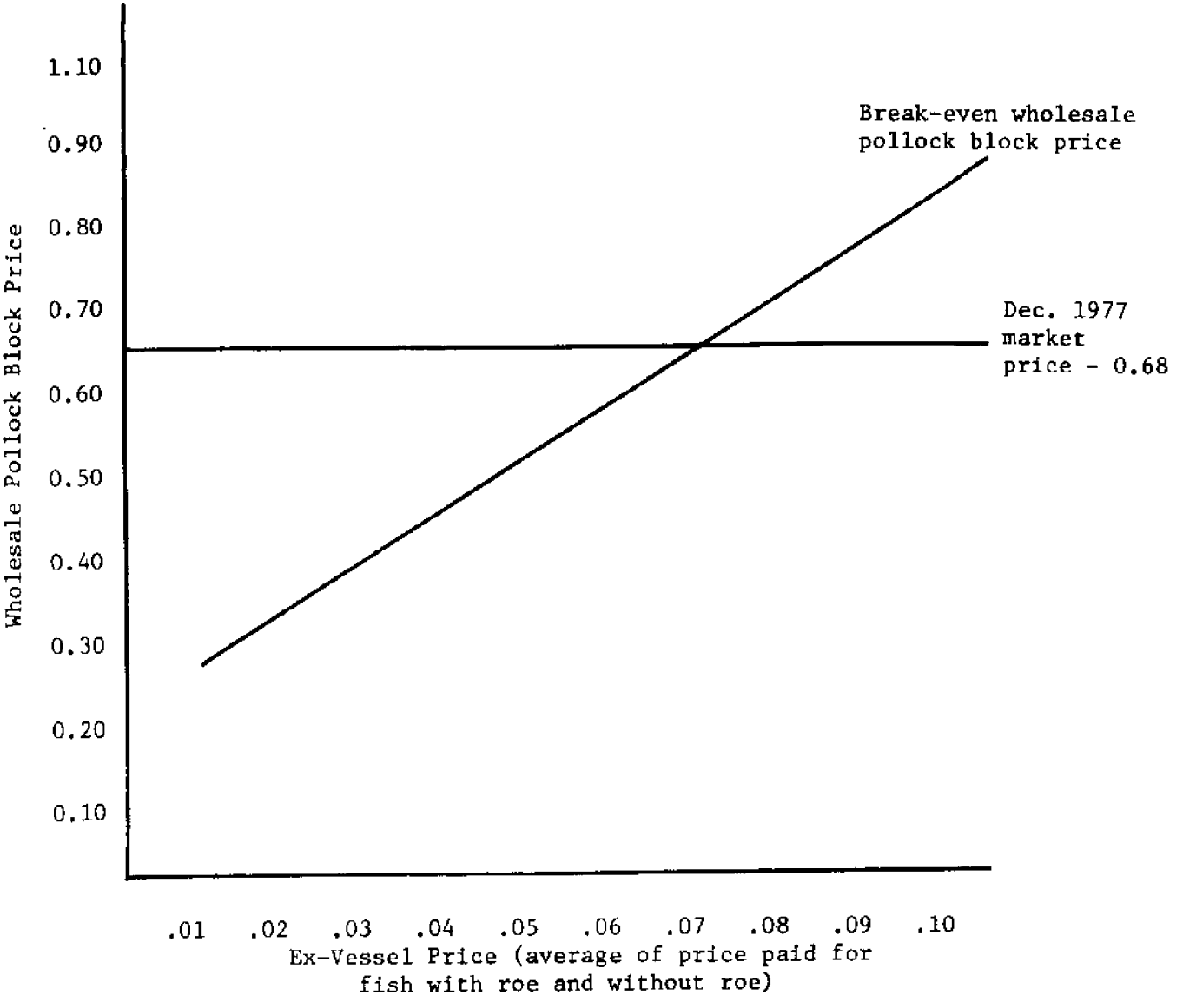

Figure 1. Break-even wholesale pollock block prices for various ex-vessel price levels: mixed production.

Gulf of Alaska precludes the use of smaller sized vessels. These physical requirements point to the crab fleet and the larger sized shrimp boats as the most likely candidates to become involved in the harvesting of pollock. The economic incentive aspects of the involvement of this group in the development of a pollock fishery have already been discussed. It should be pointed out however, that despite lucrative forecasts for shellfishing which are putting a damper on interest in the harvest of pollock, a large number of crabber/ trawler combination boats (one estimate was 35) are being built to fish in Alaska waters. This would indicate that those involved in capital investment planning do perceive a fleet which will fish a combination of crab and groundfish during a given year.

After the gestation period for new harvesting capital formation is undergone, the next problem to solve is whether these boats would operate more efficiently using onshore or offshore catch delivery methods. An often quoted study was completed in August of 1977 by Sig Jaeger, Manager of the North Pacific Fishing Vessel Owners Association in which he compared the difference in fishing vessel income generated by delivering catch to a floater rather than to an onshore processing facility. The boat used in the example was a 120' fishing vessel with an 1,125 horsepower engine.

His results indicated that delivering to a floater was a far more efficient method of operation. Profit for division between vessel and crew was 128 percent higher for the floater delivery method.

> "To equal this profit level, the shore plant must pay 76 percent more for the pollock (4.2¢ per pound more, or 9.7¢ per pound against the floater operation price of 5.5¢). Without such an adjustment in price, by comparison the shore plant has little or no financial incentive to offer the fishing vessel to compensate for the penalty of inefficiency imposed on it."[5]

According to Martin's study a 9.7¢ per pound ex-vessel price would require a break-even wholesale pollock block price of approximately 87¢ per pound. The historic high recorded in July of 1978 was 70¢ per pound.

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5 Jaeger (1977).

There are two conceivable ways this ex-vessel pricing problem could be circumvented by onshore processors. The first is a method which New England Fish Company has proposed. Their plant in Kodiak plans to produce frozen pollock fillets, a product which commands a higher wholesale price than pollock blocks. A New England Fish Company source indicated the product would be sold at $1.00 per pound.

The second method involves possible price differentials paid for incidental catch. Bycatch in pollock harvest may reach as high as 20 percent of total catch. Higher prices paid to the fishermen for higher market valued species found in pollock bycatch could mean an overall higher average price paid to fishermen for his total catch. Additional processing feasibility studies to determine break-even prices for processing of bycatch species would need to be undertaken before a final determintion could be made on the profitability of this alternative. The study by Martin dealt only with pollock with and without roe, exclusively, and a mixed production of both.

For the immediate future, it appears offshore processing is the most viable alternative for fishermen. Economic and marketing conditions for the onshore alternative are still in the developmental stage and pose uncertainties for the fisherman. The same, of course, is true in the reverse; supply uncertainty is one of the major risks in developing a processing concern as indicated in the Martin study. It can be argued that the best way to overcome these uncertainties on both sides is actual operation.

COSTS AND BENEFITS OF ALTERNATIVE DEVELOPMENT PATHS

As of mid-July, the Magnuson bill only awaits the President's signature to become law. The passage of this bill puts renewed emphasis on domestic processing capability and its effect on domestic vs. foreign quota allocations.

Passage of this bill also gives Council management officials additional leverage in the determination of the development path of the groundfishery in the Gulf of Alaska. The decision process for quota allocations inevitably involves an examination of the costs and benefits of harvesters, processors and consumers of pollock and its products, both foreign and domestic. The following section will examine those costs and benefits in an outline format. The outcome of choosing any particular management option or option combination will ultimately depend on the speed of development (or depletion) of the pollock resource in the Bering Sea as well as the Gulf of Alaska. The Gulf of Alaska cannot be examined in a vacuum when long-run costs and benefits are analysed in terms of present and future world supply "needs." The costs and benefits in this section are examined under four management options. These options are utilized to catalogue costs and benefits. They are by no means to be interpreted as an exhaustive list of management alternatives in real terms. In fact, viewed in this light, they may seem somewhat artificial, but they do serve to generalize the discussion.

The present situation in the pollock market serves as a backdrop for the analysis, i.e., pollock "shortages" in the Soviet Union, Korea, and Japan, and a record high wholesale price on Alaska pollock blocks of 70¢ per pound as of July, 1978.

Option I

Optimum yield is set equal to domestic annual harvest (DAH) and there is no foreign participation at all in the fishery.

BENEFITS AND COSTS

Consumer

A. Domestic

1. Increased pressure on already high prices for pollock blocks can be expected with resultant high prices for sticks and portions products.

B. Foreign

1. Increased pressure on already high prices for pollock blocks can be expected with resultant high prices for surimi and associated products.

Harvester

A. Domestic

1. Immediate income gains from possible joint venture operations will be foregone.

2. High pollock price would create a strong domestic investment incentive.

B. Foreign

1. Potential for unemployment and excess capacity exists for foreign fishing fleets.

Processor

A. Domestic

1. High pollock prices would create a strong investment incentive.

B. Foreign

1. Potential for unemployment and excess capacity exists in foreign floating processing operations.

National Policy

A. Domestic

1. There would exist the risk of poorer relations with and possible retaliatory measures from Japan, Korea, and the Soviet Union.

2. The situation may also aggravate policy conflicts within the federal government.

B. Foreign

1. Retaliatory measures are possible.

2. Other effects are uncertain.

Long-Run Overview

Maximum incentive for domestic development would be created but short-run world market disruption would be maximized and risk of poor foreign relations with Korea, Japan, and the Soviet Union would be accentuated along with conflicts in federal policy.

Option II

Under this option, there would be a domestic annual harvest (DAH) and a foreign allowable catch (FAC) but no joint ventures would be allowed.

BENEFITS AND COSTS

Consumer

A. Domestic and Foreign

1. Price stability may be enhanced under option II given present uncertainties in supply response by domestic harvesters under the alternative joint venture option.

Harvester

A. Domestic

1. Immediate income gains from possible joint venture operations will be foregone.

2. Investment incentive will depend on market price of pollock and its relative position compared to prices of substitute species.

B. Foreign

1. Potential fleet utilization and employment would be maximized.

Processor

A. Domestic

1. Investment incentive will be stimulated to the extent joint ventures will not present a competitive threat. The uncertain effect the option will have on market price precludes comment on its potential effect on investment in processing.

B. Foreign

1. Uncertain effects.

National Policy

A. Domestic

1. Uncertain effects.

B. Foreign

1. The effect on foreign national policy is highly dependent on the foreign view of joint ventures vs. direct foreign allocations. They may feel joint ventures are an opportunity to better foreign relations in fisheries, expand investment opportunity in U.S. fisheries and guarantee a supply of raw product by controlling the processing segment. On the other hand, they may feel a direct foreign allocation represents a more secure supply if they view joint ventures as a step toward U.S. takeover of all aspects of pollock production.

Long-Run Overview

Essentially only two points can be made with certainty. The first is domestic harvesters will suffer the foregone income effects of no joint ventures in this option, provided of course, the economic incentive to fish is there. The second is that price stability will be enhanced provided domestic annual harvest is not overstated.

Option III

In this option, all three quota alternatives are allowed, DAH, joint ventures, and FAC.

BENEFITS AND COSTS

Consumer

A. Domestic

1. Uncertain effects.

B. Foreign

1. Alternative ways of obtaining needed domestic supply are maximized.

Harvester

A. Domestic

1. Immediate income gains are possible through participation in joint venture operations.

2. Gains in expertise are possible from providing fish to a floating processor.

3. Competition between U.S. and foreign processors may bid up the ex-vessel price of pollock.

B. Foreign

1. There is unemployment potential to the extent joint ventures replace foreign allowable catch levels.

Processor

A. Domestic

1. There may be a dampening effect on investment incentive due to competition with foreign expertise.

2. The break-even price for onshore processing may increase if ex-vessel prices are bid upward due to competition for raw product between foreign and domestic processors.

B. Foreign

1. Uncertain effects.

National Policy

A. Domestic and Foreign

1. Uncertain effects.

Long-Run Overview

Any potential gains from this option are clearly in favor of the harvesting segment of the domestic industry.

Option IV

This option allows for DAH and joint ventures with no direct foreign allocation.

BENEFITS AND COSTS

Consumer

A. Domestic and Foreign

1. Outcome for both consumer groups would depend on the potential efficiency of domestic industry and joint ventures providing needed supplies without raising prices. Effect on price may also depend on quota mix as between domestic annual harvest and joint ventures.

Harvester

A. Domestic

1. Immediate income gains are possible through participation in joint venture operations.

2. Gains in expertise are possible from providing fish to a floating processor.

3. Competition between U.S. and foreign processors may bid up the ex-vessel price of pollock.

B. Foreign

1. There is a potential for unemployment and excess capacity created by nonallowance of FAC.

Processor

A. Domestic

1. There may be a dampening effect on investment incentive due to competition with foreign expertise.

2. The break-even price for onshore processing may increase if ex-vessel prices are bid upward due to competition for raw product between foreign and domestic processors.

B. Foreign

1. Uncertain effects.

National Policy

A. Domestic

1. Foreign countries would doubtless be unhappy with no FAC. This may be reflected in retaliatory measures or strained relations with the U.S.

B. Foreign

1. In addition to the above comment on FAC, foreign countries would face unemployment problems and overcapacity in its fishing fleets in the Northern Pacific.

Long-Run Overview

This option definitely favors domestic harvesters at the direct expense of total foreign participation (under the FAC) in the pollock fishery.

To sharpen the focus of this discussion, application of these four options to numerical quota allocation schemes will now be developed. The hypothetical nature of these examples is emphasized. Assume MSY (maximum sustained yield) for a fishery has been determined to be 500 metric tons. Assume for simplicity, no economic, social, or ecological justification exists to deviate Optimum Yield (OY) from Maximum Sustainable Yield (MSY) in the final Management Plan. Consider the following four-year allocation schemes as they apply to the four options under analysis.[6]

These alternative allocation schemes give rise to the following gross benefits (Table L) for the harvesting and processing sectors of the domestic economy using a 10 percent rate of discount. Keep in mind costs and benefits of these alternatives related to the foreign and domestic consumers of the product, for foreign harvesting and processing sectors and the foreign and domestic national policies, as discussed previously, are omitted. This is in no way meant to imply they are less "important," only less amenable to quantification in these simple examples.

Option I shows domestic harvesting processing capability expanding to its full potential over the four-year period in the absence of any foreign participation. It can be argued that DAH in this case may not expand substantially, however, the economic incentive in the form of high prices for pollock would be there due to the artificial shortage created by excluding foreign participation. In any event, if DAH did not expand substantially, the benefits would correspond to those in Option II A.

Option II was conceived as developing in two alternative ways depending on domestic development incentive. Option II-A indicates little domestic expansion despite competitive protection from joint ventures. Option II B indicates domestic capability expanding to its full potential.

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[6] These allocation schemes do not exhaust all possible alternatives. They were chosen to illustrate likely policy alternatives.

TABLE K
ALTERNATIVE QUOTA ALLOCATIONS

Option I

YEAR	MSY	OY	DAH	JOINT VENTURES	FAC
1	500	50	50	0	0
2	500	100	100	0	0
3	500	300	300	0	0
4	500	500	500	0	0

Option IIA

YEAR	MSY	OY	DAH	JOINT VENTURES	FAC
1	500	500	50	0	450
2	500	500	60	0	440
3	500	500	75	0	425
4	500	500	80	0	420

Option IIB

YEAR	MSY	OY	DAH	JOINT VENTURES	FAC
1	500	500	50	0	450
2	500	500	100	0	400
3	500	500	300	0	200
4	500	500	500	0	0

Option III

YEAR	MSY	OY	DAH	JOINT VENTURES	FAC
1	500	500	50	100	350
2	500	500	60	200	240
3	500	500	75	300	125
4	500	500	80	400	20

Option IV

YEAR	MSY	OY	DAH	JOINT VENTURES	FAC
1	500	500	50	450	0
2	500	500	100	400	0
3	500	500	300	200	0
4	500	500	500	0	0

TABLE L
GROSS BENEFIT ANALYSIS FOR OPTIONS I THROUGH IV

Year	Harvesting Income ($)	Gross Benefits Harvesting Sector Only ($)	Harvesting and Processing Income Combined ($)	Gross Benefits Harvesting Sectors and Processing Combined ($)
Option I				
1	50		150	
2	100		300	
3	300		450	
4	500		1,500	
		696		1,749
Option IIA				
1	50		150	
2	60		180	
3	75		225	
4	80		240	
		206		618
Option IIB				
1	50		150	
2	100		300	
3	300		450	
4	500		1,500	
		696		1,749
Option III				
1	150		250	
2	260		380	
3	375		525	
4	480		640	
		962		1,374
Option IV				
1	500		600	
2	500		700	
3	500		1,100	
4	500		1,500	
		1,586		2,978

Option III shows joint venture dominance in the fishery by the end of the fourth year. This is conceived as a likely outcome if it can be assumed joint ventures have a competitive advantage over domestic expertise.

Option IV illustrates a joint venture phase-out schedule with domestic capability expanding to fill the gap created. Again, it can be argued this may not happen in actuality. The previous feasibility discussion would indicate, however, that domestic development faces a more favorable economic and marketing climate now than at any previous time.

Setting distributional aspects aside and remembering these allocation schemes illustrate gross benefit generation only for the domestic harvesting and processing segments of the economy, Option IV is the preferred choice if harvesting and processing benefits are to be maximized. In second place for harvesting benefits is Option III; and Option I and Option II B provide the second highest benefits for the processing segment.

The important point to derive from this analysis is that benefits to the harvesting sector are maximized in any allocation scheme which distributes the entire quota to DAH and joint ventures, excluding FAC. Total benefits to both harvesting and processing sectors are maximized if joint venture quotas are transferred to DAH as soon as the domestic processing capability can handle it. This involves some sort of phase-out scheme for joint venture participation.

JOINT VENTURE PHASE-OUT

If the goal of fishery policy is to eventually phase out all foreign participation as the domestic fishery develops, what mechanism exists to assure this actually takes place? The standard answer to this question is that allocations will be made on a year-to-year basis only. This in no way assures domestic expansion will, in fact, take place to ensure the gradual phasing out of foreign participation as time goes on. The fear is that foreign involvement may preclude domestic development. Given the present climate of hysterical uncertainty in the domestic fishing industry, a question of this type is difficult to answer with precision. It would appear, however, that the closer the foreign

operation is to the desired mode of operation and scale of the developing domestic fishery, the more likely an orderly and progressive phase-out of foreign participation will occur. Further, if the phase-out occurs within the corporation itself and it is the original intent of the corporation to accomplish a phasing out process, then the phase-out is more apt to actually take place with some degree of certainty. It is suspected the fear of joint ventures precluding domestic development is a real threat in the instance where a domestic investor with a totally different operational mode planned than that utilized by the joint venture, finds himself in direct competition with an established large scale concern. The domestic investor has all the risk of product development, supply sources, financing, and marketing. He may feel that competition from a joint venture adds an uncertainty which he may or may not be willing to take on. Hence, in this instance, the orderly phase-out of foreign participation is by no means a certain nor well-defined concept.

Policy formulators should be certain that mechanisms exist that will, in fact, assure that phase-out will actually take place. In such an allowance policy, the final structure of the industry may turn out to be one of a predominance of joint ventures. This type of structure is not necessarily efficient from either the domestic or foreign viewpoint.

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APPENDIX A

ECONOMIC RESEARCH NEEDS

1. An in-depth comparative cost study of alternative modes of operation for bottomfishing as specifically applied to the Gulf of Alaska fishery.

2. An investment response model to more accurately predict the investment response of the individual firm to various fishery policy alternatives.

3. A more thorough worldwide data search for groundfish information to be applied in the development of a worldwide demand model for groundfish.

4. A cooperative effort to establish an economic data collection system for Alaska's fisheries. Mandatory compliance to data requests requires the assistance and authority of a regulatory agency. The importance of reliable economic time series data to all future economic research in fisheries in the State of Alaska cannot be overemphasized.

RESEARCH DIRECTION FOR MANAGEMENT FRAMEWORK DEVELOPMENT

As indicated under item two in the list of Economic Research Needs, what is needed is an investment model which would accurately predict alterations in disaggregated firm investment behavior as a result of policy changes or changing economic conditions within the industry.

Formulation of such a behavioral model which could predict qualitative and quantitative effects of policy alternatives and exogenous shocks in a fishery would require three major segments as outlined by Bockstael: (1) market behavior (of consumers and intermediaries), (2) domestic investment response and, (3) domestic production. The need for a study to estimate worldwide market behavior for groundfish is itemized under the section entitled Economic Research Needs. A production function predicting landings given a capital stock and the estimation of the effect of varying levels of foreign fishing on the yields of domestic fishermen is essentially a task for biologists. The development of a predictive model of domestic investment response is the topic of this chapter.

The major uncertainty involved in policy formulation regarding joint ventures is the effect that allowance of joint venture operations would have on domestic investment incentive. Allocation of excess fishery capacity requires exact knowledge of the harvesting and processing[7] capability of the domestic industry. Survey methods to determine these dynamic aspects of the investment sector are at best "hit and miss" and often totally off target due to inherent lags in management directives.

Both these problem areas in prediction of response in the investment sector of a fishery make it desirable to have a means by which domestic supply response to various policies could be ascertained; the effect on supply being determined through the investment response of individual firms (fishermen) based on their perception of altered gross revenues and costs. Recent neoclassical investment analysis particularly that of Jorgenson, Jorgenson and Stephenson, and Jorgenson and Siebert, was not

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[7] The consideration of processing capacity in the determination of DAH is undecided at this time.

particularly applicable to the peculiar aspects of investment in a fishery. Among the problems these models failed to address were: (1) the question of entry and exit in the decision-making process of the firm engaged in fishing operations, (2) the problem of indivisible or lumpy, nonhomogeneous units of capital stock, (3) the inherent problems of the specification of a production function in a fishery, and (4) the effects of nonquantifiable or noneconomic variables on the decision process. For all these reasons, Logit analysis was explored as an alternative approach.

McFadden (1974) developed a theory of individual population choice with discrete alternatives based on the theory of individual utility maximization and applied it to problems in urban transportation.

The standard continuous-type maximization problem in econometrics includes among the arguments of the objective function, observed attributes of alternatives (e.g., prices), observed attributes of the individual (e.g., income), and unobserved factors (e.g., tastes, experience, etc.). The unobserved factors are assumed to be randomly distributed with mean zero or distributed around some exact value of common taste. Since quantities vary continuously, it is expected that measurement error in those continuous variables will dominate the effects of unmeasurable variables. All systematic "variation in population choice is then attributable to individual choice variation at the intensive margin (e.g., buy or product more or less) caused by fluctuations in exogenous variables common to all individuals."[8] When the alternative set is discrete and the individuals all face the same exogenous variables, the specification will predict the same choice will be made by all individuals. Measurement error or individual's errors in optimization is the only cause of variation in the observed choice.

McFadden's contribution involves specifying the systematic variation in population choice such that it describes shifts at the extensive margin; i.e., where individuals are shifting from one alternative to another. He derives a distribution of population choice by defining assumptions concerning the distribution of the unobserved population characteristics (tastes, etc.). The following is the approach developed by McFadden.

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[8] Bockstael (1976).

The data generating mechanisms is a series of random drawings of individuals from a population. For each independent trial, (with or without replication), the individual's attributes, S, his set of available alternatives, B, and his actual choice, X, are recorded. The observed choice is viewed as a drawing from a multinomial distribution with selection (conditional) probabilities $P(\chi|S,B,)$ for all $\chi \varepsilon B$.

Each individual has a decision function h relating his vector of individual attributes and the alternative set to one member of the alternative set. The population contains an entire distribution of individual decision functions. Thus, the probability that an individual with attributes, S, and alternative set, B, chooses alternative χ is equal to the probability of occurrence of that decision function h, which yields choice χ or,

$$P(\chi|S,B) = \pi\ (h|h(S,B) = \chi)$$

The utility function of the individual is written as:

$$U = V\ (S,\ \chi) + \varepsilon\ (S,\ \chi)$$

V is the nonstochastic part of the function reflecting average population tastes. ε is the stochastic portion reflecting the individual's idiosyncrasies. Assume the individual will choose the alternative which maximizes his utility; h denotes his decision rule and $B = \{\chi_i,\ldots,\chi_j\}$. Then the probability that an individual drawn randomly from the population, with attributes S and alternative set B will choose alternative χ_i can be written as:

$$P_i = P\ (\varepsilon(S,\ \chi_j) - \varepsilon(S,\ \chi_i) < V(S,\chi_i) - V(S,\ \chi_j),\ V_j,\ j \neq i)$$

Since this is equal to $\pi(h_\varepsilon |\ h_\varepsilon(S,B,) = \chi_i))$ a joint cumulative distribution can be derived from π on the values $\varepsilon(S,\ \chi_j),\ V_j$. Probabilistic models such as the Logit are associated with these joint cumulative distributions on the stochastic portion of the individual's decision functions.

The functional form of the multinomial or "conditional" Logit in which the observed portion of the individual's decision function is linear in a set of measurable variables, Z, and their unknown parameters, θ, i.e.,

$V\ (S,\chi) = Z'\ \theta$ is expressed as[9] $P_{in} = P\ (\chi_{in}\ S_n B_n) = \frac{e^{Z'\ in\theta}}{\sum_{j=1}^{Jn} e^{Z'\ jn\theta}}$.

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[9] For a detailed derivation see McFadden (1974).

This is interpreted as the probability of an individual n, with attributes, S_n, and alternative set, B_n (which has J_n members), choosing alternative X_i.

Suppose, now, a sampling experiment is carried out yielding observations on N individuals; attributes and alternatives of those individuals varying over the sample. Remembering that individual choices are viewed as drawings from a multinomial distribution with selection probabilities $P_{in}(\chi_{in}|S_n,B_n)$ then the likelihood of a sample can be expressed as the function:

$$L = \prod_{n=1}^{N} \prod_{j=1}^{J_n} P_{in}^{C_{in}}$$

Where C_{in} 1 in alternative i is chosen by individual n and = 0 if alternative i is not chosen by individual n. The log likelihood function is:

$$\text{Log } L = \sum_{n=1}^{N} \sum_{i=1}^{J_n} C_{in} \log \left\{ \sum_{j=1}^{J_n} \text{EXP}\left[(Z_{jn} - Z_{in})' \theta\right] \right\}$$

"Since observations on choices of individuals in the population are interpreted as drawings from a statistical distribution, maximization of the likelihood function yields estimates of the θs. The analysis, thus, makes it possible to estimate the function dependence of the probability of a decision on the explanatory variables. The formulation is extremely general, and admissible explanatory variables include attributes of alternatives, interactions of alternative and individual attributes, and alternative-specific shift variables. The latter is of the nature of a dummy variable associated with a specific alternative and reflects the tendency to choose this alternative when the explanatory variables take the same values for all alternatives. Explanatory variables cannot be chosen which are invariant over the individual's alternative set, as the coefficients would be unidentified."[10]

In addition, the likelihood function possesses several desirable properties. Provided explanatory variables are generic to all the alternatives, different individuals need not be faced with identical alternatives. Further, new alternatives may be introduced without re-estimating the model, provided coefficients

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10 Ibid p. 32

have been estimated for the generic variables. Relative odds will remain the same among the old alternatives but the probability that each of the old alternatives will be chosen will decrease proportionately to accommodate the probability of occurrence of the new alternative.

These properties appear to be highly conducive to application to investment response in a fishery and, in fact, were applied to the New England groundfish industry in 1976 in a Ph.D. thesis by Bockstael. The development of her model follows:

The net vessel owner's share is defined as:

$$O_t = (1\ x/100)\ [P_t Q_t\ - E_t\ ]\ - M_t\ -\ N_t\ -\ U_t$$

where: x = lay percentage going to crew;

P_t = price in t of output;

Q_t = catch; E

E_t = trip expenses;

M_t = maintenance, repair, etc.;

N_t = insurance costs;

U_t = other miscellaneous costs to owner.

The objective function is then formulated:

$$\max W = \{ \sum_{t=0}^{T} (O_t - r_t B - D_t - A (O_t))\beta\ t/v\}$$

Where:

V = own capital invested;

β = "personal" discount rate;

rb = interest on borrowed capital;

D = depreciation;

A = taxes;

T = "appropriate" time horizon.

The vessel owner, it is assumed, will maximize W by choosing the appropriate capital stock.

Bockstael then discusses three qualifying observations concerning the objective function.

The first concerns the importance of financial constraints to the fishermen in their financial decision-making process. She discusses a situation where "given a fixed amount of own capital (K), the borrowing rate to the entrepreneur may be constant up to some borrowed amount (αK), and then becomes effectively infinite."[11]

The second qualification recognizes the fact that sociological factors may affect the variables of the objective function. These sociological factors may, however, simply be reflected in differing "personal" discount rates.

The final discussion involves treatment of risk. As Massé (1962) points out, "the passage of time is inseparable from the appearance of risk." Thus, since investment involves time, risk is an inherent feature of the process.

These qualifications were incorporated into the model to the degree feasible. In some instance the data base was inadequate to make desired specifications and in others considerable extension of Logit analysis would have been required.

To reiterate the direction of the model: "The behavioral unit in this study is the firm, and the alternative set facing each firm is comprised of various investment decisions. Specifically, the observations are on New England groundfish fishermen who may maintain their present vessel in the groundfish industry or who may invest or disinvest in that industry. For purposes of

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[11] Ibid p. 37.

simplification, investment is defined as gross investment; no attempt at explicity incorporation depreciation has been made."[12]

In the Bockstael model investment and disinvestment was treated solely as that which comes about through the acquisition or sale of vessels. Gear purchase or modification, or vessel improvement was not included. This could lead to underestimates of investment response. To apply this model to the Gulf of Alaska groundfishery, modifications of the definition of investment would be desirable. Decisions made concerning entry into the groundfishery often involve vessel modification and gear acquisition. These changes could involve an investment of up to $500,000 per vessel; an amount not easily ignored in modelling investment behavior for this fishery.

The problem of uncertainty is treated by assuming prices, yields, etc., that effect investment decision-making by a fisherman are those he perceives at the time the investment decision is made.

The gestation period for an investment decision from conception to operation was taken to be one year. Given lags in gear acquisiton from foreign countries and vessel construction, this may be a somewhat unrealistic assumption for the Alaska groundfishery particularly since there is an apparent lack of information and expertise in Alaska concerning groundfishing methods.

There were seven discrete alternatives available to the fisherman in the model. Six of those alternatives were varying sizes of capital stock based on vessel size and age. The seventh alternative was associated with the decision to either switch fisheries or exit the industry totally.

In the case of the Alaska groundfishery where much of the investment funds may originate in firms which have had no direct involvement in fishing operations, a decision rule should be included which treats entry into the fishery from related or unrelated industry. In this case, likely candidates would have to be chosen. Both this alternative and the one already included treating the situation where a firm switches fisheries, will

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[12] Ibid p. 38.

provide some explanation of the incentive phenomenon previously discussed and, heretofore, so difficult to predict using survey methods.

Generic variables used to explain alternative choices were weighted average prices, yields in catch per day, and gross estimates of capital. All variables were classified by vessel age and size to conform to the alternatives. The seventh alternative selected the one "best alternative fishery" for each port and its generic variable attributes to be used in the decision of whether or not to transfer to a different fishery.

Three specifications of the model were formulated, each with two explanatory variables meshing with objective function goals; a gross revenue variable (the product of price and yield), and a variable representing the difference between the value of capital stock of each alternative and the resale value of the capital stock held in time t. The decision variable was choice of capital stock for t + 1, given the capital stock held in t.

The first specification used all observations on firms which were in the fishery in either of both years for a given pair or years, t and t + 1. Those entering the fishery in t were allowed all seven alternatives, and those entering in t + 1, the first six; the decision to enter the fishery for those entering in t + 1 was assumed already made.

The second specification included only those firms observed to have altered their capital stock during the time frame of reference. The final specification allowed observations only on those firms who entered the fishery either from an alternative fishery or a non-fishing occupation. The general form of the model is expressed as:

$$P_{in} = 1/\{ \sum_{j=1}^{J_n} \exp\ [(Z_{1jn} - Z_{1in})\theta_1 + (Z_{2jn} - Z_{2in})\theta_2] \}$$

where:

Z_{1jn} = annual gross revenues associated with alternative j for individual n

Z_{2jn} = net capital cost associated with alternative j for individual n

P_{in} = probability of individual n choosing alternative n

J_n = maximum number of alternatives faced by individual n

θ_1 = coefficient of annual gross revenues variable, to be estimated

θ_2 = coefficient of net capital cost variable, to be estimated

Alternatives:

j = 1 vessel of less than 50 G.T. built before 1960

j = 2 vessel of 50 to 150 G.T. built before 1960

j = 3 vessel of greater than 150 G.T. built before 1960

j = 4 vessel of less than 50 G.T. built after 1960

j = 5 vessel of 50 to 150 G.T. built after 1960

j = 6 vessel of greater than 150 G.T. built after 1960

j = 7 exit from groundfish industry.

The maximum likelihood method of estimation was employed. Its estimates are consistent and asymptotically efficient, and it provides an added advantage over the alternative method (a weighted squares procedure) of not requiring repetitions on observations. The Beckson (1953) method requires that there be repeated observations for each value of the vector of explanatory variables. "The sample sizes necessary to obtain a few repetitions of every unique combination of values of the K explanatory variables may be large, depending on the problem, and will increase with K."[13]

The results of the three specifications appear on the following pages.

Positive and significant coefficients are interpreted as having an increasing effect on the probability of a given choice.

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[13] Ibid p. 46

TABLE M

RESULTS OF LOGIT INVESTMENT MODEL -
SAMPLE OF ALL INDIVIDUALS

Variable	Annual Gross Revenues	Net Capital Cost
1972-1973		
Coefficient	-.00016	-.00441
T-statistic	(-1.34)	(-9.72)[a]
Log likelihood = -848.6		
Percentage predicted correctly = 25.6%[a]		
Chi square = 153.99		
1971-1972		
Coefficient	.00018	-.00464
T-statistic	(1.75)	(-10.03)[a]
Log likelihood = -852.4		
Percentage predicted correctly = 19.7%[a]		
Chi square = 158.01		
1970-1971		
Coefficient	-.00039	-.0047
T-statistic	(-.68)	(-8.69)[a]
Log likelihood = -839.9		
Percentage predicted correctly = 33.5%[a]		
Chi square = 168.95		

[a]Significant at 99 percent level

TABLE N

RESULTS OF LOGIT INVESTMENT MODEL -
SAMPLE OF INDIVIDUALS WHO CHANGED CAPITAL STOCK

Variable	Annual Gross Revenues	Net Capital Cost
Coefficient	.00152[a]	-.00706[a]
T-statistic	(7.802)	(-11.41)

Log likelihood = 698.3
Percent predicted correctly = 45.2%[a]
Chi square = 313.98

[a]Significant at 95 percent level.

TABLE O

RESULTS OF LOGIT INVESTMENT MODEL -
SAMPLE OF INDIVIDUALS WHO ENTERED FISHERY

Variable	Annual Gross Revenues	Net Capital Cost
Coefficient	.00374[a]	-.00897[a]
T-statistic	(3.36)	(-7.75)

Log likelihood = 309.7
Percent predicted correctly - 49.0%[a]
Chi square = 125.93

[a]Significant at 95 percent level.

Similarly a negative and significant coefficient would have a depressing effect.

The results indicate the model is less successful in explaining the behavior of those who do not change their capital stock. This could be indicative of a group which has strong "traditional" ties to a fishery and is less responsive to variations in gross revenues and capital costs. An alternative specification or data stratification would perhaps better capture these sociological aspects of behavior.

In the second specification, gross revenues and capital costs are extremely strong determiners of behavior as they are in specification three.

It is obvious Logit analysis offers both a promising and flexible approach to modelling investment behavior in the fishery. Alternative sets could be modified, and additional fixed costs could be added to adapt to particular fisheries and expand the explanatory power. Interest rates could be incorporated to model effects of federal financial assistance programs. The most obvious extension and the most important in terms of modelling the Alaska groundfishery is to incorporate the decision process involved in deciding to enter a fishery.

The value of an investment model of this type in predicting behavioral response to alternative policy goals would be invaluable in management decision making.