scomm

#9:142

Consultant file; ISER

Economist: only time will tell

By ROSEMARY SHINAHARA
Daily News Staff Writer

Daniel A. Seiver, a University of Alaska economist who stirred some contention in economist circles when he made a computer-based forecast for unemployment and inflation in Alaska this year, is the first to admit that only time will tell.

"There's no guarantee a computer model will do better than an informed expert," he said in an interview. "To make a forecast you have to make assumptions."

SEIVER'S FORECAST was more pessimistic than those made by Bob Richards, an Alaska Pacific Bank economist, who has been making predictions about the state economy for several years.

Seiver, a member of the university's Institute of Social and Economic Research, said unemployment in Alaska will fall by 14 per cent below 1976 this year. Richards responded to the forecast in a letter to the institute in which he cited what he considered defects in the computer model.

The employment decrease this year is likely to be less than the model's estimate of 14 per cent, Richards said. "A decline of less than 10 per cent and closer to about 5 per cent seems more probable."

Daniel A. Seiver

THE INSTITUTE has been working to build a computer model that can be used for accutate long-range predictions for years. While long-term forecasts indicate the state will have "relatively smooth and steady growth," recent experience has been of the "boom-bust" nature, Seiver says in a paper made public last week.

He spent several months developing equations to feed into a computer to produce a picture of economic activity for the year.

The prediction assumes that consumer prices in the U.S. will be up 7 per cent over last year, and U.S. wages will be up 8 per cent over 1976.

IN ALASKA, it was assumed mining, manufacturing, agriculture, forestry, and fisheries employment would be up 15 per cent, federal government employment would be unchanged, and pipeline employment would average about 5,000 persons.

How accurate the assumptions were, remains to be seen.

Meanwhile, Seiver said, "I think it's healthy to have a little controversy." More is on the horizon, in the form of separately created computer models being developed for the state Department of Economic Development.

WHEN THE STATE finishes its studies, Alaskans will have three economic forecasts to choose from. But Seiver notes that none of them are pure computer, or pure informed expertise. They are influenced by each other. "People's forecasts tend to gravitate toward each other," he said.

Seiver has been with the institute since 1974, but previous papers have been in his main field — population studies. Gathering data for population studies is a problem, and the next major efforts in the field will probably be undertaken after the 1980 census, Seiver said.

ISER

UNIVERSITY OF ALASKA
FAIRBANKS, ALASKA 99701

PLEASE REPLY TO:
707 A Street, Suite 206
Anchorage, Alaska 99501

INSTITUTE OF SOCIAL & ECONOMIC RESEARCH

The Honorable Clark Gruening
Chairman
Committee on the Permanent Fund
Alaska House of Representatives
Juneau, Alaska 98111

May 16, 1977

Dear Mr. Gruening:

This is a letter proposal in response to the May 11 inquiry from your staff assistant, Brian Rogers, to Arlon R. Tussing, Adjunct Professor of Economics. The Institute of Social and Economic Research of the University of Alaska (ISER) proposes to conduct a study and produce a report under the direction and supervision of Professor Tussing on the following topics:

1. How efficient are capital markets in Alaska today? What amount of substitution of permanent fund for private capital would there be under approaches being considered for the permanent fund?

2. To what extent would permanent fund outlays have the ability to expand Alaska's tax base and diversify the Alaska economy?

3. Under four or five alternative management approaches for the permanent fund, what would be the investment impacts? What are the growth implications?

4. How would impacts differ if the permanent fund investments are out-of-state instead of in-state? What are the implications of using the permanent fund for social purposes (a) directly through loans, etc. or (b) indirectly, by expanding the economy to create a greater tax base, which could be used for social purposes in the future?

5. Could the permanent fund be used to stabilize the Alaska economy, to smooth the boom/bust cycle, or to even out the rate of growth?

6. Could the permanent fund be used to increase rural employment through cottage industries, or dispersal of economic activity?

7. What analytical or policy issues (whether included in the foregoing list or not) should the committee investigate in depth?

It is understood that the study and report proposed in this letter are to be in the nature of a general reconnaisance, and need not involve collection or processing of original quantitative data.

ISER will deliver to the Committee, within thirty (30) days of final acceptance of this proposal, one photo-ready reproducible copy of the final report.

The total price of the study and report is six thousand dollars ($6,000), which price includes all professional effort, overhead, communications, supplies and travel, including one (1) day of testimony or briefings at a place in Alaska of the Committee's choosing, within thirty (30) days of delivery of the final report.

Your signature on this letter constitutes acceptance of the proposal contained in it. Any modifications proposed by you should be marked on the text and initialed, and the letter returned to ISER for our acceptance.

Sincerely,

Arlon R. Tussing, Professor of Economics

E. Lee Gorsuch, Director

ACCEPTED:

_____

_____
Title

AT/rk

ISER

25 Long term Rev Proj
35 MAP model for FF

PLEASE REPLY TO:
707 A Street, Suite 206
Anchorage, Alaska 99501

INSTITUTE OF SOCIAL & ECONOMIC RESEARCH

The Honorable Clark Gruening
Chairman
Committee on the Permanent Fund
Alaska House of Representatives
Juneau, Alaska 98111

May 16, 1977

Dear Mr. Gruening:

This is a letter proposal in response to the May 11 inquiry from your staff assistant, Brian Rogers, to Arlon R. Tussing, Adjunct Professor of Economics. The Institute of Social and Economic Research of the University of Alaska (ISER) proposes to conduct a study and produce a report under the direction and supervision of Professor Tussing on the following topics:

1. How efficient are capital markets in Alaska today? What amount of substitution of permanent fund for private capital would there be under approaches being considered for the permanent fund?

2. To what extent would permanent fund outlays have the ability to expand Alaska's tax base and diversify the Alaska economy?

3. Under four or five alternative management approaches for the permanent fund, what would be the investment impacts? What are the growth implications?

4. How would impacts differ if the permanent fund investments are out-of-state instead of in-state? What are the implications of using the permanent fund for social purposes (a) directly through loans, etc. or (b) indirectly, by expanding the economy to create a greater tax base, which could be used for social purposes in the future?

5. Could the permanent fund be used to stabilize the Alaska economy, to smooth the boom/bust cycle? or to even out the rate of growth?

6. Could the permanent fund be used to increase rural employment through cottage industries, or dispersal of economic activity?

7. What analytical or policy issues (whether included in the foregoing list or not) should the committee investigate in depth?

Arlon: Sacramento
Seattle - SATURDAY
call Inst

It is understood that the study and report proposed in this letter are to be in the nature of a general reconnaisance, and need not involve collection or processing of original quantitative data.

ISER will deliver to the Committee, within thirty (30) days of final acceptance of this proposal, one photo-ready reproducible copy of the final report.

The total price of the study and report is six thousand dollars ($6,000), which price includes all professional effort, overhead, communications, supplies and travel, including one (1) day of testimony or briefings at a place in Alaska of the Committee's choosing, within thirty (30) days of delivery of the final report.

Your signature on this letter constitutes acceptance of the proposal contained in it. Any modifications proposed by you should be marked on the text and initialed, and the letter returned to ISER for our acceptance.

Sincerely,

Arlon R. Tussing, Professor of Economics

E. Lee Gorsuch, Director

ACCEPTED:

Title

AT/rk

Send to Brian + Doug Court 647

Brian Rogers

PF: ISER

707 A Street, Suite 206
Anchorage, AK 99501

UNIVERSITY OF ALASKA
FAIRBANKS, ALASKA 99701

INSTITUTE OF SOCIAL AND ECONOMIC RESEARCH

March 25, 1977

Dear Sir or Madam:

You or any members of your organization are cordially invited to attend a one-day workshop, entitled "Economic Methods for Analysis of Alaska's Future." The workshop is sponsored by the University of Alaska's Institute of Social and Economic Research and will be held on Saturday, April 9, at the AMU campus, Student Union Building, commencing at 9 a.m.

The morning session of the workshop will concentrate on the economic relationships which allow one to model the behavior of the Alaska economy and analyze population growth and changes in levels and types of economic activities. The afternoon sessions will address an approach to (a) assessing the economic impact of fiscal policy options, such as lowering personal income taxes, and of large scale economic projects, such as gas pipelines or hydroelectric projects; and, (b) forecasting future demand requirements for manpower, energy and transportation. The workshop will conclude with a presentation of ISER's efforts to develop tools to assess who benefits from Alaska's growth.

The sessions will be conducted by members of ISER's economics staff assisted by Dr. David Kresge, a senior economist with the National Bureau of Economic Research. An agenda for the workshop and discussion materials will be available at the registration desk.

Lunch will be a brown bag affair and all participants are advised to bring their own lunch. Soft drinks and coffee will be available throughout the workshop.

A registration fee of $5.00 per person will be collected at the door.

I hope you'll be able to attend.

Sincerely,

Lee Gorsuch

Lee Gorsuch
Director

LG/mm

ISER Contract

Lee Gorsuch

MAP Computes capabilities
staff – memo on potential application
Dept Revenue is using old version of MAP
Both – prelim runs By 1985, P.F. $36.1 bn
G.F. $6 billion.
Raises one Q → how much $ into P.F.
expenditures impact assessment
alternatives for $60 G.F. altering
1) improve q of life, living conditions
2) pupil/teacher, health care,
Develop series of indicators — quality of service
additional effort – capital market $ flows
Doing whatever
Aplan, Scott Goldsmith
consumption, Capital market data
By end of next week –
outline of things-to do
My sched open → call Thursday in AM –
FR. + weekend
Flex – Monday

ALASKA

REVIEW OF

BUSINESS AND ECONOMIC

CONDITIONS

UNIVERSITY OF ALASKA, INSTITUTE OF SOCIAL, ECONOMIC AND GOVERNMENT RESEARCH APRIL 1974, Vol.XI, No. 1

ESTIMATED GROSS STATE PRODUCT FOR ALASKA

This Review presents a breakdown by industry of the estimated gross state product for Alaska. Gross state product or GSP is the total market value of all the goods and services produced in the state for a given period. The estimated GSP presented here provides a new way of measuring both volume and value of production in the state, and the results should prove valuable to economists, businessmen, and others who have an interest in the behavior of the state's economy. Use of an estimated GSP to measure Alaska production is similar to the way gross national product is used to measure total United States' production.*

Estimated GSP gives us the most complete measure of economic activity in Alaska. It differs from other measurements previously available because estimated GSP is based on a wider range of information sources and makes use of census data. Also, unlike previously available measures, the estimated GSP provided here has been adjusted to reflect "constant dollar" values (based on the 1958 dollar).

* However "gross national product" is not strictly analogous since it is not confined to production within the confines of a geographic boundary; GNP may also include production of U.S. owned industries in other countries. Gross state product as used here is confined to production within the boundaries of the state.

Estimating the Gross State Product

Table 1 compares 1961 with 1972 estimated GSP, as well as the gross product for each industrial sector. These figures were derived by either of two alternative ways: (1) by figuring how much the total value of a given industry's output exceeds the cost of materials used in production, or (2) by figuring the sum of the industry's payments for employee compensation, profits, and other such production costs as indirect business taxes and depreciation. The type of information available determined which method we used to estimate the gross product for a given industry. Calculated by either method, however, the sum of the gross products of all Alaska industries equals the state's output or GSP.

Price Deflators

When measured by current prices, many of the changes in gross product since 1961 have resulted from changes in price rather than changes in actual production. To measure and compare actual production, gross product was adjusted to compensate for price changes. This was done by dividing industry gross product (as shown in table 2) by the "price deflators" shown in tables 1 and 3.

Because employee compensation constitutes the major component of gross product in most in-

ALASKA REVIEW OF BUSINESS
AND ECONOMIC CONDITIONS
VOL. XI, NO. 1
APRIL 1974

Published by the
Institute of Social, Economic and Government Research,
University of Alaska, College, Alaska

Robert W. Hiatt – President, University of Alaska
Victor Fischer – Director of the Institute of Social, Economic and Government Research

Ronald Crowe
Institute Editor

Authors: Dave T. Kresge
Monica E. Thomas

dustries, the bulk of the price deflators was derived by comparing changes in the cost of labor based on average annual employee earnings. In a few industries, the price deflators were calculated directly from changes in output prices.

"Real" GSP (adjusted for price changes) was estimated by dividing the GSP (at each year's prices) for each industry by a price deflator for that industry. The results are the "constant dollar" gross products shown in table 4. These show what the value of each year's Alaska product would have been if valued at 1958 *national* prices instead of 1958 *Alaska* prices. In other words, we adjusted the GSP for changes both in Alaska prices and for differences between prices in Alaska and the rest of the United States. The resulting GSP estimates provide consistent indicators of the physical volume of production in the major industrial sectors of Alaska.

Sources

In order to make use of the maximum amount of available information, the gross product estimates were derived from the largest possible variety of sources. The two major sources were the wage and salary estimates prepared by the Alaska Department of Labor and the industry data collected by the U.S. Bureau of the Census. The information concerning Alaska industry was obtained from the census of manufactures, commercial fisheries, mineral industries, construction industries, and government. In addition to these sources, some of the data was taken from Alaska personal income estimates and from the U.S. industry gross product estimates prepared by the U.S. Department of Commerce.

More complete information on data sources is contained in the appendix. The appendix also provides a detailed outline of the procedures used in computing the various gross product estimates.

Alaska Gross Product, 1961-1972

As table 1 shows, the Alaska GSP for 1972 is estimated to have been $2.4 billion. GSP has grown at an average rate of nearly 10 percent a year since 1961. However, a large part of this growth represents price increases, not gains in actual production. The GSP deflator (a general price index for Alaska output) increased at nearly 4 percent a year and real output grew at 5.7 percent a year between 1961 and 1972.

Within the context of the relatively rapid growth in the total economy, there were significant changes in the industrial composition of production (see figure 1). The most striking change was in the mining sector, which grew quite rapidly due to expanded petroleum activities. The mining sector increased its share of total real output from 5.4 percent in 1961 to 17.5 percent in 1972. The other sectors experiencing above-average real growth were state and local government; transportation, communications, and public utilities; and trade, finance, and services. It is interesting to note that those last two industrial groups, the so-called support sectors, produced about 45 percent of total real GSP in 1972, and they accounted for more than half of the real growth between 1961 and 1972.

In contrast to the support sectors, the renewable resource-based industries grew at only 0.4 percent per year from 1961 to 1972, and their share of real GSP fell from 13.8 percent to 7.8 percent. Thus, two traditional Alaska industries, fisheries and forest products, have contributed very little to the real growth of the Alaska economy since statehood. Another traditional sector contributing little to growth was the federal government. Although the federal sector remains an important component of the Alaska economy, its growth in current prices was only moderate and, in real terms, its gross product actually declined slightly between 1961 and 1972. As a result, the federal government's share of real GSP was cut almost in half over that period.

Changes in Alaska Production, 1971-1972

In 1972, Alaska GSP increased by 7 percent

TABLE 1

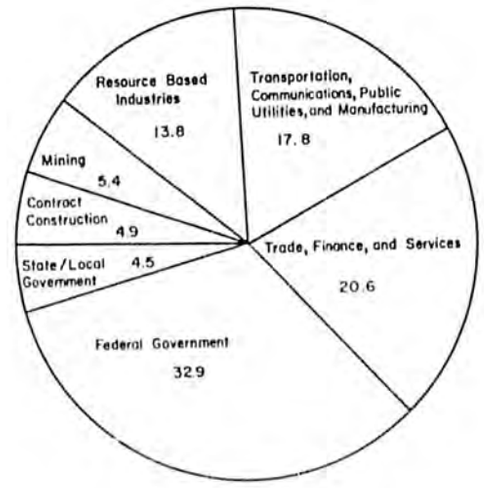
ALASKA GROSS PRODUCT, 1961 AND 1972

	GROSS PRODUCT IN CURRENT DOLLARS (Millions of Dollars at Current Prices)			GROSS PRODUCT IN CONSTANT DOLLARS (Millions of 1958 Dollars at Average U.S. Prices)			PRICE DEFLATORS (1958 U.S. Prices = 100)		
	1961	1972	Average Annual Rate of Change 1961-1972	1961	1972	Average Annual Rate of Change 1961-1972	1961	1972	Average Annual Rate of Change 1961-1972
All Industries, Total GSP	863.3	2416.3	9.8%	683.6	1253.0	5.7%	126.3	192.8	3.9%
Renewable Resource Industries	102.5	166.2	4.5	94.3	98.2	0.4	108.7	169.2	4.1
Agriculture	1.4	1.4	0						
Fisheries	74.0	94.8	2.3	71.1	57.0	-2.0	104.1	166.3	4.4
Forest Products	27.1	70.0	9.0	23.2	41.2	5.4	116.8	169.9	3.5
Mining (Including Petroleum)	37.1	224.0	17.8	36.9	219.1	17.6	100.5	102.2	0.2
Contract Construction	81.7	271.2	11.5	33.6	61.4	5.6	243.2	442.0	5.6
Manufacturing*	8.3	26.8	11.2	6.8	14.8	7.3	122.6	181.2	3.6
Transportation	47.0	120.9	9.0	42.5	90.2	7.1	110.6	134.0	1.8
Communications	65.4	104.9	4.4	60.8	94.2	4.1	107.5	111.4	0.3
Public Utilities	12.7	48.9	13.0	11.9	40.7	11.8	106.5	120.0	1.1
Trade	98.2	288.2	10.3	68.0	153.1	7.7	144.4	188.2	2.4
Wholesale	31.6	89.3	9.9	24.8	58.1	8.0	127.5	153.8	1.7
Retail	66.6	198.9	10.5	43.2	95.0	7.4	154.0	209.3	2.8
Finance, Insurance, and Real Estate	48.9	186.2	12.9	40.2	102.4	8.9	121.7	181.8	3.7
Services	57.5	187.2	11.3	32.4	80.1	8.6	177.5	233.7	2.5
Government	304.0	791.8	9.1	256.2	298.8	1.4	118.7	265.0	7.6
Federal	248.5	490.6	6.4	225.1	212.5	-0.5	110.4	230.9	6.9
State and Local	55.5	301.2	16.6	31.1	86.3	9.7	178.4	349.0	6.3

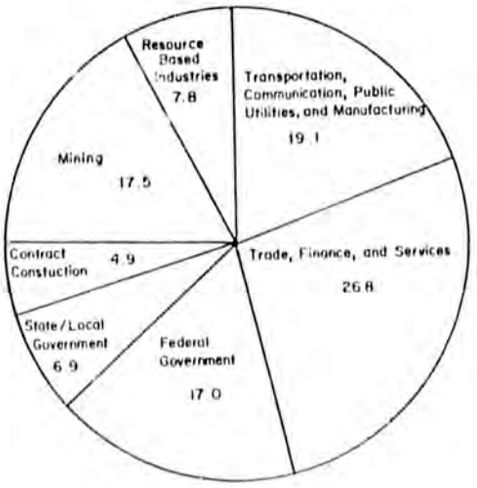
* Other than lumber, wood, and paper products or food (fish) processing

(see figure 2 and table 2). However, the price deflator is estimated to have increased by nearly 10 percent, so real GSP actually fell by 2.7 percent. The major factor causing this was the continuing decline in mining (petroleum) activity. The gross product in mining fell by 11 percent in current prices and by 20 percent in constant dollars. The resource-based industries other than mining also showed a substantial drop in output: 5 percent in current prices and 16 percent in real terms. On the other hand, the support industries, state and local government, and contract construction all displayed strong growth, both in current prices and in real terms. The federal government had a decline in real output (employment), but this was more than offset by the increase in average wages paid, so output in current prices actually rose 5 percent.

FIGURE 1
DISTRIBUTION OF CONSTANT DOLLAR GROSS STATE PRODUCT, 1961 AND 1972



1961



1972

FIGURE 2
CHANGE IN ALASKA GROSS PRODUCT, 1971-1972
(Percent)

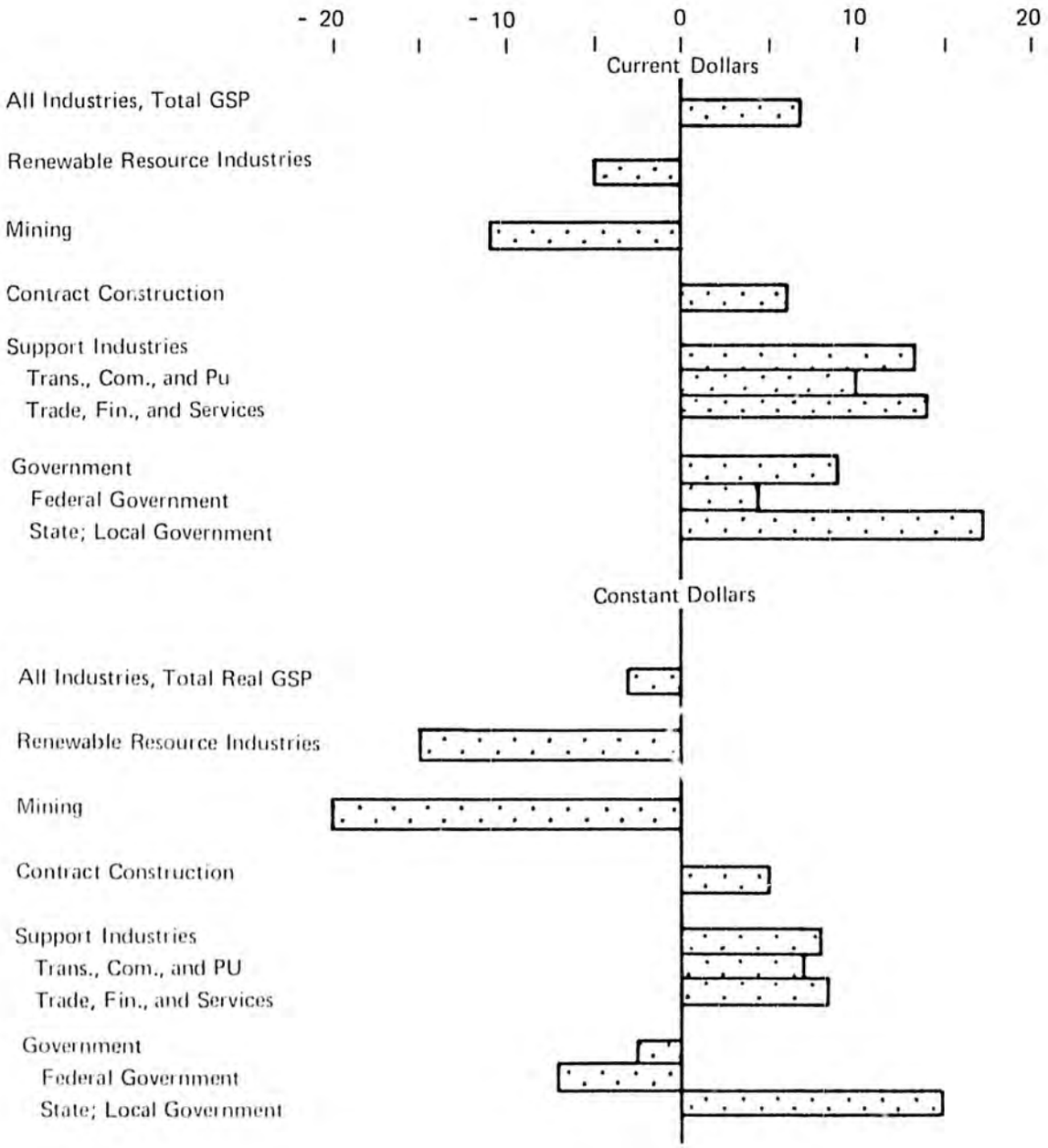


TABLE 2
ALASKA GROSS PRODUCT IN CURRENT DOLLARS BY INDUSTRY, 1961-1972
(Millions of Dollars)

	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
ALL INDUSTRIES	863.3	902.2	944.1	1089.3	1189.6	1305.1	1468.0	1662.4	1921.1	2116.6	2257.3	2416.3
AGRICULTURE, FORESTRY AND FISHERIES	27.5	34.2	27.7	33.3	40.6	47.1	28.0	46.0	39.0	55.8	49.4	50.0
ALL INDUSTRIES EXCEPT AGRICULTURE, FORESTRY AND FISHERIES	835.8	868.0	916.4	1056.0	1149.0	1258.0	1440.0	1616.4	1882.1	2060.8	2207.9	2366.3
Employee Compensation	582.7	603.8	640.9	729.7	785.6	848.5	947.2	1035.2	1184.7	1339.9	1461.8	1602.3
Indirect Business Tax	51.5	54.0	55.0	57.6	69.0	76.6	83.7	96.7	114.8	131.5	145.2	157.2
Other Factor Payments	201.6	210.2	220.5	268.7	294.4	332.9	409.1	484.5	582.6	589.4	600.9	606.8
MINING	37.1	41.9	44.4	46.3	46.6	65.9	158.3	220.1	334.4	301.3	250.6	224.0
Employee Compensation	12.6	13.8	13.8	13.7	14.4	19.1	30.7	41.3	61.2	56.4	47.5	42.7
Indirect Business Tax	2.7	3.2	3.4	3.4	3.6	5.3	9.5	13.6	19.9	19.2	16.6	14.5
Other Factor Payments	21.8	24.9	27.2	29.2	28.6	41.5	118.1	165.2	253.3	225.7	186.5	166.8
Metal Mining	3.5	3.2	2.6	1.8	2.3	2.5	2.1	1.8	2.0	3.4	2.8	1.9
Employee Compensation	3.1	2.9	2.3	1.6	2.0	2.2	1.8	1.7	1.9	3.2	2.4	1.8
Indirect Business Tax	.4	.4	.3	.2	.3	.3	.3	.2	.2	.4	.3	.2
Other Factor Payments	0	-.1	0	0	0	0	0	-.1	-.1	-.2	.1	-.1
Oil and Gas	28.6	33.4	36.9	39.1	38.1	57.2	150.8	213.5	328.1	293.5	242.1	215.9
Employee Compensation	6.7	7.9	8.7	9.1	8.9	13.4	25.9	36.9	56.9	50.7	41.9	37.4
Indirect Business Tax	2.2	2.6	2.9	3.0	3.1	4.8	9.0	13.2	19.6	18.7	16.1	14.1
Other Factor Payments	19.7	22.9	25.3	27.0	26.1	39.0	115.9	163.4	251.6	224.1	184.1	164.4
Other Mining	5.0	5.3	4.9	5.4	6.2	6.2	5.4	4.8	4.3	4.4	5.7	6.2
Employee Compensation	2.8	3.0	2.8	3.0	3.5	3.5	3.0	2.7	2.4	2.5	3.2	3.5
Indirect Business Tax	.1	.2	.2	.2	.2	.2	.2	.2	.1	.1	.2	.2
Other Factor Payments	2.1	2.1	1.9	2.2	2.5	2.5	2.2	1.9	1.8	1.8	2.3	2.5
CONTRACT CONSTRUCTION	81.7	83.3	89.9	137.3	155.9	158.5	170.7	180.0	211.3	223.8	254.3	271.2
Employee Compensation	50.6	51.6	55.9	84.8	96.1	97.7	104.5	109.9	129.8	138.7	158.0	170.6
Indirect Business Tax	1.7	1.8	1.8	2.6	3.1	3.2	3.3	3.7	3.9	4.3	5.0	5.5
Other Factor Payments	29.4	29.9	32.2	49.9	56.7	57.6	62.9	66.4	77.6	80.8	91.3	95.1
MANUFACTURING	83.3	79.0	78.0	95.2	105.2	116.9	103.5	125.7	111.6	144.5	149.7	143.0
Employee Compensation	43.8	45.8	48.6	50.8	60.6	62.5	62.5	70.5	77.5	94.3	98.0	102.2
Indirect Business Tax	9.3	7.9	7.8	7.9	10.7	11.0	9.3	10.4	10.7	13.5	13.8	13.4
Other Factor Payments	30.2	25.3	21.6	36.5	33.9	43.4	31.7	44.8	23.4	36.7	37.9	27.4
Food and Kindred Products	47.9	38.3	33.1	46.5	52.0	62.7	44.1	60.6	37.6	59.3	60.1	46.2
Employee Compensation	22.1	20.7	20.6	20.3	26.7	27.1	22.5	26.1	26.8	35.5	35.6	34.5
Indirect Business Tax	8.1	6.5	6.3	6.3	9.1	9.4	7.6	8.3	8.4	10.8	11.0	10.5
Other Factor Payments	17.7	11.1	6.2	19.9	16.2	26.2	14.0	26.2	2.4	13.0	13.5	1.2
Lumber and Wood Products	7.3	8.0	10.0	11.3	13.3	16.5	23.5	25.1	26.5	31.3	32.0	34.7
Employee Compensation	5.6	6.2	7.9	8.7	10.4	12.9	18.5	19.8	21.0	24.7	25.4	27.7
Indirect Business Tax	.2	.2	.3	.3	.3	.4	.6	.7	.7	.8	.8	.9
Other Factor Payments	1.5	1.6	1.8	2.3	2.6	3.2	4.4	4.6	4.8	5.8	5.8	6.1
Paper and Allied Products	19.8	23.1	24.9	26.1	27.3	25.2	22.6	24.7	27.8	31.4	32.7	35.3
Employee Compensation	9.7	11.3	12.2	12.8	13.4	12.4	11.5	12.2	13.7	15.7	16.4	17.7
Indirect Business Tax	.3	.4	.4	.4	.4	.4	.4	.4	.4	.5	.5	.6
Other Factor Payments	9.8	11.4	12.3	12.9	13.5	12.4	11.6	12.1	13.7	15.2	15.8	17.0
Other Manufacturing	8.3	9.6	10.0	11.3	12.6	12.5	12.3	15.3	19.7	22.5	24.9	26.8
Employee Compensation	6.4	7.6	7.9	9.0	10.1	10.1	9.9	12.4	16.0	18.4	20.6	22.3
Indirect Business Tax	.7	.8	.8	.9	.9	.8	.7	1.0	1.2	1.4	1.5	1.4
Other Factor Payments	1.2	1.2	1.3	1.4	1.6	1.6	1.7	1.9	2.5	2.7	2.8	3.1
TRANSPORTATION	47.0	49.9	52.8	56.8	63.5	66.1	74.9	77.9	100.8	106.3	107.3	120.9
Employee Compensation	34.1	35.5	37.0	39.1	41.8	43.9	51.5	55.2	73.2	80.1	76.4	84.8
Indirect Business Tax	4.1	3.8	3.3	3.2	3.6	3.8	4.1	4.4	5.6	6.4	8.3	9.7
Other Factor Payments	8.8	10.6	12.5	14.5	18.1	18.4	19.3	18.3	22.0	19.8	22.6	26.4

Table 2 (continued)

	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
TRANSPORTATION (cont.)												
Trucking and Warehousing	9.7	10.8	11.5	13.5	16.7	13.2	17.2	18.6	26.7	30.6	27.2	28.6
Employee Compensation	6.5	7.2	7.6	9.1	11.0	8.8	12.0	12.8	18.8	21.0	19.3	20.7
Indirect Business Tax	.7	.8	.9	1.0	1.2	1.0	1.0	1.1	1.5	1.8	1.6	1.6
Other Factor Payments	2.5	2.8	3.0	3.4	4.5	3.4	4.2	4.7	6.4	7.8	6.3	6.3
Water Transportation	9.3	10.0	10.4	10.1	9.2	12.2	12.3	11.7	10.4	11.0	10.2	12.8
Employee Compensation	8.0	8.8	8.7	8.3	7.6	9.9	10.2	9.5	9.0	9.4	9.0	11.1
Indirect Business Tax	.4	.3	.3	.2	.2	.3	.3	.3	.3	.3	.4	.5
Other Factor Payments	.9	.9	1.4	1.6	1.4	2.0	1.8	1.9	1.1	1.3	.8	1.2
Air Transportation	23.8	24.6	26.3	28.8	32.5	34.9	38.8	40.2	55.4	54.9	58.7	68.5
Employee Compensation	16.6	16.4	17.6	18.7	19.9	21.5	24.9	28.0	39.8	43.0	40.5	45.6
Indirect Business Tax	2.7	2.3	1.7	1.7	1.8	2.0	2.2	2.3	3.0	3.3	5.2	6.4
Other Factor Payments	4.5	5.9	7.0	8.4	10.8	11.4	11.7	9.9	12.6	8.6	13.0	16.5
Other Transportation	4.2	4.5	4.6	4.4	5.1	5.8	6.6	7.4	8.3	9.8	11.2	11.0
Employee Compensation	3.0	3.1	3.1	3.0	3.3	3.7	4.4	4.9	5.6	6.7	7.6	7.4
Indirect Business Tax	.3	.4	.4	.3	.4	.5	.6	.7	.8	1.0	1.1	1.2
Other Factor Payments	.9	1.0	1.1	1.1	1.4	1.6	1.6	1.8	1.9	2.1	2.5	2.4
COMMUNICATIONS	65.4	61.5	61.1	58.9	62.1	67.4	64.3	67.4	68.6	71.3	98.1	104.9
Employee Compensation	30.9	27.9	26.8	26.4	27.6	30.1	28.4	29.9	31.6	34.6	47.3	51.3
Indirect Business Tax	8.5	8.0	7.6	7.0	7.5	7.2	8.0	8.0	8.2	8.9	12.2	12.6
Other Factor Payments	26.0	25.6	26.7	25.5	27.0	30.1	27.9	29.5	28.8	27.8	38.6	41.0
PUBLIC UTILITIES	12.7	15.5	17.6	20.4	23.7	24.9	27.9	31.0	33.5	36.5	43.8	48.9
Employee Compensation	4.2	5.0	5.6	6.6	7.6	8.0	9.0	10.1	11.1	12.7	14.8	16.5
Indirect Business Tax	1.3	1.7	1.8	2.0	2.5	2.5	3.0	3.5	3.8	4.4	5.3	5.8
Other Factor Payments	7.2	8.8	10.2	11.8	13.6	14.4	15.9	17.4	18.6	19.4	23.7	26.6
TRADE	98.2	100.1	104.5	113.5	131.8	147.3	165.5	184.3	215.7	241.1	263.9	288.2
Employee Compensation	57.2	57.1	60.6	65.5	76.3	85.1	96.4	106.8	126.3	142.9	154.7	172.1
Indirect Business Tax	14.4	16.1	16.5	17.5	21.1	24.9	27.8	32.9	39.2	45.4	50.6	56.5
Other Factor Payments	26.2	26.9	27.4	30.5	34.4	37.3	41.3	44.6	50.2	52.8	58.6	59.6
Wholesale Trade	31.6	29.1	29.7	33.7	37.8	45.1	50.3	56.0	70.0	79.0	82.2	89.3
Employee Compensation	17.5	15.7	16.2	18.5	20.7	24.5	27.9	30.5	38.4	44.0	45.3	50.0
Indirect Business Tax	6.6	6.7	6.7	7.3	8.7	10.6	11.8	13.7	17.1	19.7	21.5	23.4
Other Factor Payments	7.5	6.7	6.8	7.9	8.4	10.0	10.6	11.8	14.5	15.3	15.4	15.9
Retail Trade	66.6	71.0	74.8	79.8	94.0	102.2	115.2	128.3	145.7	162.1	181.7	198.9
Employee Compensation	39.7	41.4	44.4	47.0	55.6	60.6	68.5	76.3	87.9	98.9	109.4	122.1
Indirect Business Tax	7.8	9.4	9.8	10.2	12.4	14.3	16.0	19.2	22.1	25.7	29.1	33.1
Other Factor Payments	19.1	20.2	20.6	22.6	26.0	27.3	30.7	32.8	35.7	37.5	43.2	43.7
FINANCE, INSURANCE AND REAL ESTATE	48.9	56.8	64.8	73.2	86.7	96.0	94.7	101.7	113.8	138.3	157.4	186.2
Employee Compensation	10.3	11.7	13.5	15.3	17.7	19.6	19.8	22.3	25.4	31.3	35.6	43.2
Indirect Business Tax	7.8	9.6	10.8	11.9	14.4	16.2	16.3	17.4	20.4	25.7	29.3	34.4
Other Factor Payments	30.8	35.5	40.5	46.0	54.6	60.2	58.6	62.0	68.0	81.3	92.5	108.6
SERVICES	57.5	63.0	62.7	69.9	78.3	84.9	96.5	109.7	126.8	144.1	160.0	187.2
Employee Compensation	35.0	38.4	38.5	43.0	48.3	52.4	60.7	70.6	83.0	95.3	106.7	127.1
Indirect Business Tax	1.7	1.9	2.0	2.1	2.5	2.5	2.4	2.8	3.1	3.7	4.1	4.8
Other Factor Payments	20.8	22.7	22.2	24.8	27.5	30.0	33.4	36.3	40.7	45.1	49.2	55.3
Hotels, Motels, and Lodges	-	-	6.6	7.3	9.6	11.4	12.5	12.4	13.6	15.0	16.8	18.5
Employee Compensation			3.9	4.4	5.7	6.6	7.3	7.3	8.3	9.2	10.5	11.9
Indirect Business Tax			.5	.5	.7	.8	.8	.8	.9	1.1	1.2	1.3
Other Factor Payments			2.2	2.4	3.2	4.0	4.4	4.3	4.4	4.7	5.1	5.3
Personal Services	-	-	6.1	6.4	6.7	7.3	7.6	8.6	8.7	9.5	10.2	10.7
Employee Compensation			3.5	3.6	3.9	4.2	4.4	5.0	5.2	5.7	6.1	6.4
Indirect Business Tax			.2	.2	.2	.2	.2	.3	.3	.3	.4	.4
Other Factor Payments			2.4	2.6	2.6	2.9	3.0	3.3	3.2	3.5	3.7	3.9

Table 2 (continued)

	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
SERVICES (cont.)												
Business Services	-	-	12.5	15.5	17.3	17.9	21.5	28.2	32.9	27.7	27.1	25.5
Employee Compensation			8.6	10.7	11.9	12.5	15.2	20.3	23.8	20.4	19.6	18.8
Indirect Business Tax			.3	.4	.4	.4	.3	.5	.5	.3	.3	.3
Other Factor Payments			3.6	4.4	5.0	5.0	6.0	7.4	8.6	7.0	7.2	6.4
Medical Services	-	-	12.7	14.4	15.0	16.6	18.0	18.8	23.4	29.3	35.5	46.8
Employee Compensation			6.0	6.9	7.2	8.1	9.0	9.8	12.6	17.0	22.1	30.9
Indirect Business Tax			.2	.2	.2	.2	.2	.2	.2	.3	.3	.4
Other Factor Payments			6.5	7.3	7.6	8.3	8.8	8.8	10.6	12.0	13.1	15.5
Other Services	-	-	24.8	26.3	29.7	31.7	36.9	41.7	48.2	62.6	70.4	85.7
Employee Compensation			16.5	17.4	19.6	21.0	24.8	28.2	33.1	43.0	48.4	59.1
Indirect Business Tax			.8	.8	1.0	.9	.9	1.0	1.2	1.7	1.9	2.4
Other Factor Payments			7.5	8.1	9.1	9.8	11.2	12.5	13.9	17.9	20.1	24.2
GOVERNMENT	304.0	317.0	340.6	384.5	395.2	430.1	483.7	518.6	565.6	653.6	722.8	791.8
Employee Compensation	304.0	317.0	340.6	384.5	395.2	430.1	483.7	518.6	565.6	653.6	722.8	791.8
Indirect Business Tax												
Other Factor Payments												
Federal Government	248.5	251.2	262.0	299.5	295.4	316.5	353.9	369.2	392.8	444.9	467.9	490.6
Employee Compensation	248.5	251.2	262.0	299.5	295.4	316.5	353.9	369.2	392.8	444.9	467.9	490.6
Other Factor Payments												
State and Local Government	55.5	65.8	78.6	85.0	99.8	113.6	129.8	149.4	172.8	208.7	254.9	301.2
Employee Compensation	55.5	65.8	78.6	85.0	99.8	113.6	129.8	149.4	172.8	208.7	254.9	301.2
Indirect Business Tax												
Other Factor Payments												

TABLE 3

PRICE DEFLATORS FOR ALASKA GROSS PRODUCT BY INDUSTRY

(1958 Prices = 100 for U.S. Average)

	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
ALL INDUSTRIES	126.3	128.1	130.2	139.6	142.8	145.0	146.2	150.5	152.7	164.0	175.3	192.8
AGRICULTURE, FORESTRY, AND FISHERIES	88.9	101.5	97.1	94.9	117.0	111.1	124.0	153.9	156.3	148.6	161.1	246.1
MINING	100.5	99.5	96.5	93.0	95.3	89.8	87.7	91.9	92.2	94.2	91.7	102.2
Metal Mining	100.0	89.3	92.0	90.4	89.0	102.9	60.6	79.8	80.1	91.3	73.1	76.0
Oil and Gas	97.5	97.0	94.1	89.7	90.7	85.7	87.2	91.5	91.7	93.6	91.3	101.7
Other Mining	122.3	128.9	122.3	129.5	142.7	142.7	129.6	118.9	182.6	186.0	133.4	142.8
CONTRACT CONSTRUCTION	243.2	255.2	263.7	303.3	295.6	333.8	352.0	371.3	394.3	409.9	436.8	442.0
MANUFACTURING	118.7	119.0	121.7	123.0	127.4	127.1	128.7	133.0	140.6	145.5	148.8	154.3
Food and Kindred Products	119.3	117.0	115.7	118.9	124.0	119.8	116.5	119.4	121.6	127.2	128.5	125.9
Lumber and Wood Products	134.9	143.7	141.9	151.4	148.6	153.5	169.7	178.2	185.1	199.4	195.1	207.5
Paper and Allied Products	111.1	110.1	117.0	115.2	117.2	122.5	119.1	127.0	127.7	130.0	138.6	144.2
Other Manufacturing	122.6	135.0	138.7	139.1	149.6	149.5	138.6	150.0	159.2	175.1	180.0	181.2
TRANSPORTATION	110.6	113.9	113.5	114.1	113.6	108.7	109.5	107.2	112.6	118.5	129.9	134.0
Trucking and Warehousing	108.2	112.8	116.3	120.1	120.6	124.2	125.9	130.2	142.0	141.2	144.2	144.7
Water Transportation	111.5	115.1	118.1	116.0	120.4	120.6	136.3	138.1	134.9	145.7	149.0	158.2
Air Transportation	108.2	111.5	104.9	105.9	102.2	95.0	92.5	86.8	94.1	97.8	112.8	119.5
Other Transportation	129.6	131.2	172.5	165.2	191.0	170.3	175.9	207.0	202.9	222.2	227.5	219.5
COMMUNICATIONS	107.5	107.0	107.5	108.4	108.3	109.2	109.8	109.7	111.1	110.9	109.9	111.4
PUBLIC UTILITIES	106.5	105.6	107.9	107.5	107.1	108.2	110.7	113.2	112.4	115.7	116.8	120.0
TRADE	144.4	144.2	146.4	151.1	154.7	156.9	160.8	166.2	172.3	175.6	181.1	188.2
Wholesale Trade	127.5	120.4	122.4	126.8	127.1	132.0	131.6	135.3	141.8	145.0	147.5	153.8
Retail Trade	154.0	157.2	158.8	164.5	169.3	171.3	178.0	184.7	192.1	195.8	202.0	209.3
FINANCE, INSURANCE, AND REAL ESTATE	121.7	122.1	124.7	131.1	136.5	142.2	143.1	147.2	158.0	162.1	174.7	181.8
SERVICES	177.5	183.1	167.2	164.5	171.0	178.0	182.4	194.5	203.5	211.0	219.5	233.7
Hotels, Motels, and Lodges			186.0	161.1	188.8	200.0	203.2	204.5	199.0	205.6	220.6	222.0
Personal Services			159.1	131.5	153.5	163.4	170.5	169.7	175.8	170.9	181.7	188.5
Business Services			163.1	167.7	161.6	168.3	176.8	204.6	205.3	187.6	174.2	168.8
Medical Services			142.5	157.3	154.1	159.9	163.9	167.1	187.1	210.6	235.8	267.8
Other Services			181.9	178.6	186.3	191.6	194.6	207.0	217.8	234.3	242.8	255.8
GOVERNMENT	118.7	120.4	125.2	139.2	139.1	148.2	162.6	176.3	190.3	215.6	235.7	265.0
Federal Government	110.4	110.2	112.7	127.2	124.1	131.7	145.3	155.8	167.5	189.8	203.6	230.9
State and Local Government	178.4	187.0	198.3	209.1	215.8	227.4	240.6	261.5	275.8	303.4	332.1	349.0

TABLE 4

ALASKA GROSS PRODUCT IN CONSTANT DOLLARS BY INDUSTRY, 1961-1972

(Millions of 1958 Dollars at Average U.S. Prices)

	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
ALL INDUSTRIES	683.6	704.3	725.3	780.3	832.9	900.2	1003.8	1104.5	1258.4	1290.8	1287.5	1253.0
AGRICULTURE, FORESTRY, AND FISHERIES	30.9	33.7	28.5	35.1	34.7	42.4	22.6	29.9	25.0	37.6	30.7	20.3
MINING	36.9	42.1	46.0	49.8	48.9	73.4	180.6	239.6	362.7	319.7	273.3	219.1
Metal Mining	3.5	3.6	2.8	2.0	2.6	2.4	3.5	2.3	2.5	3.7	3.8	2.5
Oil and Gas	29.3	34.4	39.2	43.6	42.0	66.7	172.9	233.3	357.8	313.6	265.2	212.3
Other Mining	4.1	4.1	4.0	4.2	4.3	4.3	4.2	4.0	2.4	2.4	4.3	4.3
CONTRACT CONSTRUCTION	33.6	32.6	34.1	45.3	52.7	47.5	48.5	48.5	53.6	54.6	58.2	61.4
MANUFACTURING	70.2	66.4	64.1	77.4	82.6	92.0	80.4	94.5	79.4	99.3	100.6	92.7
Food and Kindred Products	40.2	32.7	28.6	39.1	41.9	52.3	37.9	50.8	30.9	46.6	46.8	36.7
Lumber and Wood Products	5.4	5.6	7.0	7.5	9.0	10.7	13.8	14.1	1 .3	15.7	16.4	16.7
Paper and Allied Products	17.8	21.0	21.3	22.7	23.3	20.6	19.8	19.4	21.8	24.2	23.6	24.5
Other Manufacturing	6.8	7.1	7.2	8.1	8.4	8.4	8.9	10.2	12.4	12.8	13.8	14.8
TRANSPORTATION	42.5	43.8	46.5	49.8	55.9	60.8	63.4	72.7	89.5	89.7	82.6	90.2
Trucking and Warehousing	9.0	9.6	9.9	11.2	13.8	10.6	13.7	14.3	18.8	21.7	18.9	19.8
Water Transportation	8.3	8.7	8.8	8.7	7.6	10.1	9.0	8.5	7.7	7.5	6.8	8.1
Air Transportation	22.0	22.1	25.1	27.2	31.8	36.7	41.9	46.3	58.9	56.1	52.0	57.3
Other Transportation	3.2	3.4	2.7	2.7	2.7	3.4	3.8	3.6	4.1	4.4	4.9	5.0
COMMUNICATION	60.8	57.5	56.8	54.3	57.3	61.7	58.6	61.4	61.7	64.3	89.3	94.2
PUBLIC UTILITIES	11.9	14.7	16.3	19.0	22.1	23.0	25.2	27.4	29.8	31.5	37.5	40.7
TRADE	68.0	69.4	71.4	75.1	85.2	93.9	102.9	110.9	125.2	137.3	145.7	153.1
Wholesale Trade	24.8	24.2	24.3	26.6	29.7	34.2	38.2	41.4	49.4	54.5	55.7	58.1
Retail Trade	43.2	45.2	47.1	48.5	55.5	59.7	64.7	69.5	75.8	82.8	90.0	95.0
FINANCE, INSURANCE, AND REAL ESTATE	40.2	46.5	52.0	55.8	63.5	67.5	66.2	69.1	72.0	85.3	90.1	102.4
SERVICES	32.4	34.4	37.5	42.5	45.8	47.7	52.9	56.4	62.3	68.3	72.9	80.1
Hotels, Motels, and Lodges	-	-	3.5	4.5	5.1	5.7	6.2	6.1	6.8	7.3	7.6	8.3
Personal Services			3.8	4.9	4.4	4.5	4.5	5.1	4.9	5.6	5.6	5.7
Business Services			7.7	9.2	10.7	10.6	12.2	13.8	16.0	14.8	15.6	15.1
Medical Services			8.9	9.2	9.7	10.4	11.0	11.3	12.5	13.9	15.1	17.5
Other Services			13.6	14.7	15.9	16.5	19.0	20.1	22.1	26.7	29.0	33.5
GOVERNMENT	256.2	263.2	272.1	276.2	284.2	290.3	297.5	294.1	297.2	303.2	306.6	298.8
Federal Government	225.1	228.0	232.5	235.5	238.0	240.3	243.6	237.0	234.5	234.4	229.8	212.5
State and Local Government	31.1	35.2	39.6	40.7	46.2	50.0	53.9	57.1	62.7	68.8	76.8	86.3

APPENDIX

PROCEDURES FOR ESTIMATING GROSS STATE PRODUCT BY INDUSTRY

APPENDIX

PROCEDURES FOR ESTIMATING GROSS PRODUCT BY INDUSTRY

Industrial Classification

In estimating gross product, economic activity in Alaska was classified into the following eleven industrial sectors:

1. Agriculture, forestry, and fisheries
2. Mining
3. Contract construction
4. Manufacturing
5. Transportation
6. Communications
7. Public utilities
8. Trade
9. Finance, insurance, and real estate
10. Services
11. Government

Certain sectors were further broken down by splitting them into industrial components as follows:

1. Mining
   - Metal mining
   - Oil and gas
   - Other mining
2. Manufacturing
   - Food and kindred products
   - Lumber and wood products
   - Paper and allied products
   - Other manufacturing
3. Transportation
   - Trucking and warehousing
   - Water transportation
   - Air transportation
   - Other transportation
4. Trade
   - Wholesale trade
   - Retail trade
5. Services
   - Hotel, motels, and lodges
   - Personal services
   - Business services
   - Medical services
   - Other services
6. Government
   - Federal government
   - State and local government

In the six industrial sectors listed above, separate estimates were made for each of the industrial components. The results were then summed to obtain the sector totals.

Gross Product—Direct Estimates

Gross product estimates for the first four industrial sectors (agriculture, forestry, and fisheries; mining; contract construction; and manufacturing) were based on various sources of direct information concerning industrial production. In most cases, census data were also used to provide important check points for the estimates.

Agriculture, Forestry, and Fisheries

In Alaska, the forestry industry, as defined by the Bureau of the Census, generates negligible gross product. This occurs because the Census Bureau includes almost the entire forest products industry in the manufacturing sector as lumber and paper products. Gross product estimates for Alaska fisheries and agriculture were obtained using the following procedures:

Agriculture: The agriculture gross product was taken to be equal to the farm earnings reported in the personal income statistics.[1] Farm earnings include wages, salaries, and proprietors' incomes.

Fisheries: Alaska fisheries data were obtained from the 1967 census of commercial fisheries.[2] Alaska value added was estimated from census data on the basis of gross receipts, operating cost, and depreciation. Depreciation in the production process for Alaska was estimated using the relationship between depreciation and operating cost data for total U.S.[2] This was done by first figuring the ratio of depreciation to total operating costs for the U.S. This ratio was then multiplied by Alaska operating costs to obtain an estimate of Alaska depreciation and an estimate of operating costs excluding depreciation. Value added was then calculated by subtracting operating costs, excluding depreciation, from gross receipts. Alaska value added was divided by gross receipts from the Alaska census. To obtain the Alaska fisheries gross products, the resulting ratio was multiplied by the value to Alaska fishermen[3] of the 1961-1972 catch. Data on value of the 1972 catch are not yet available, so a rough estimate was made based on preliminary press reports.

Because forestry production is negligible, fishing and

agriculture gross products were added to obtain the cumulative gross product for the agriculture, forestry, and fisheries category for 1961-1972. On the average, commercial fishing accounted for 97 percent of the gross product in this industrial sector.

Mining

Mining was divided into three components: metal mining, oil and gas, and other mining. Gross product estimates were calculated separately for each component; the procedure was similar for all three.

Mineral industries census data for 1963 and 1967 were obtained for the U.S.[4,5] and Alaska.[6,7] These data included value added and payrolls in metal mining, oil and gas, and other mining. Data were also obtained on U.S. gross product estimates for 1963 and 1967 from the gross product originating series.[8]

Value added from the gross product originating series was divided by U.S. value added in mining (from the census) for each of the three components, and the result was an adjustment factor for each component in 1963 and 1967. These adjustment factors were multiplied by value added (from the Alaska census) in mining, yielding adjusted value added for Alaska metal mining, oil and gas, and other mining. The purpose of the adjustment is to make the final estimates consistent with the concepts used by the U.S. Bureau of Economic Analysis to determine the Gross National Product.

The adjusted Alaska value-added data were divided by Alaska census payroll data for each component. These ratios were calculated for both 1963 and 1967. For metal and other mining, the 1963 and 1967 ratios were each averaged and then multiplied by 1961-1972 Alaska wages and salaries to obtain gross product estimates by year in each of the two industries. For the oil and gas industry, the 1963 ratio was multiplied by Alaska wages and salaries from 1961 1966. The 1967 ratio was multiplied by 1967-1972 Alaska oil and gas wages and salaries.[9] The ratio was shifted to the 1967 level because of the structural change that resulted from the Cook Inlet oil fields coming into production in 1967.

Lease acquisition charges – bonuses and rentals – (for which the state received almost $1 billion in 1969) are not treated in the accounts as income originating in current production. Instead, they are considered as capital expenditures that enter value added as capital consumption allowances (percentage depletion or cost depletion) over the productive life of the leases. The 1969 lease bonus payments, for example, will appear as part of the value of production in future years, under the heading "other factor income."

Contract Construction

For the purposes of calculation, contract construction was broken down into three small subcategories: 1) building construction–general contractors, 2) construction other than building–general contractors, and 3) construction–special trade contractors.[10] Data on value added and payroll for these three were calculated from the 1967 census on the U.S.[11] and Alaska.[12] The gross product estimate for 1967 U.S. contract construction was obtained from the gross product originating (GPO) series.[13] The ratio of U.S. GPO value added to U.S. census value added was calculated. This ratio was multiplied by Alaska census value added components to obtain adjusted value added estimates for Alaska. The adjusted Alaska value added estimates were divided by Alaska census payrolls, yielding a ratio for contract construction. These ratios were then multiplied by Alaska wages and salaries[9] from the three component industries, 1961-1972, to obtain Alaska gross product estimates. The three sets of gross product estimates were summed to obtain Alaska contract construction gross product estimates for 1961-1972.

Manufacturing

Food and Kindred Products: Gross product estimates for 1963 and 1967 U.S. food and kindred products were obtained from the gross product originating (GPO) series.[8] Estimates of value added by manufacture of food and kindred products were obtained for the U.S.[14,15] and Alaska[16,17] from the 1963 census and 1967 census. For 1963 and 1967, ratios were obtained of U.S. gross product estimates (from the GPO series) to value added by manufacture (from Census of Manufactures). These ratios were multiplied, respectively, by Alaska value added (from Census of Manufactures) by manufacture in 1963 and 1967. This yielded an adjusted Alaska value-added estimate for those years. Material costs were measured as wholesale value of fishery products minus value to fishermen of catch[3] minus value added. Estimates of material costs were obtained from census data for 1963 and 1967. For these years, material costs were divided by wholesale value of fisheries products. The resulting two ratios were averaged. "K" was defined as the average ratio of material costs to wholesale value. Estimated Alaska gross product for food and kindred products by year was defined as (1-K) times the wholesale value of fisheries products by year minus the value to fishermen of catch. This relationship was used to calculate gross product estimates of 1961-1971 Alaska food and kindred products.

Because 1972 data were not yet available at the time of

writing, rough estimates of the value of catch were used to estimate gross product in 1972.

Lumber and Wood Products: U.S.[14,15] and Alaska[16,17] data were collected from the 1963 and the 1967 census on value added by manufacture of lumber and wood products. U.S. gross product estimates were also obtained from the gross product originating series.[8] For 1963 and 1967, U.S. value added estimates from the GPO series were divided by value added estimates from the U.S. census. The resulting ratios were multiplied by 1963 and 1967 value added estimates from the Alaska census. These two estimates were divided, respectively, by wages and salaries from 1963 and 1967 Alaska lumber and wood products.[9] To obtain gross product estimates for 1961-1972, the resulting two ratios were averaged, and the average ratio was multiplied by wages and salaries from 1961-1972 Alaska lumber and wood products wages and salaries.[9]

Paper and Allied Products: Alaska census data on paper and allied products were unavailable due to disclosure regulations. U.S. census data[14,15,18] for 1958, 1963, and 1967 were collected on value added and payrolls. U.S. gross product estimates were also collected from the gross product originating series[8] for those years. Value added to payroll ratios were obtained for paper and allied products. The ratios for the three years were averaged. Ratios were obtained of (GPO) value added to (census) value added in U.S. paper and allied products. These three ratios were then averaged to obtain an adjustment factor to convert census estimates to national income concepts. The two sets of averaged ratios were multiplied. The resulting ratio was multiplied by Alaska paper and allied products, wages, and salaries[9] from 1961-1972 to obtain gross product estimates for those years.

Other Manufacturing: "other manufacturing" in Alaska consists primarily of printing and publishing; chemicals; stone, clay, and glass products; machinery; and transportation equipment. Value added by manufacture for 1963 and 1967 was obtained from U.S. census data for the above four categories. U.S. gross product estimates[8] for the same years were obtained from the gross product originating series. Adjustment factors were computed as the ratios of value added (from GPO) to value added (from census) for the four categories for 1963 and 1967. Data from the Alaska census[16,17] on value added by manufacture and payroll for the four categories were obtained for 1963; data on printing and publishing only were available for 1967. The adjustment factors derived from U.S. census data were multiplied by the Alaska ratios to make the Alaska value added estimates consistent with national income concepts. Ratios of adjusted value added to payroll were calculated for the four categories. The resulting ratios were used to compute 1963 and 1967 weighted averages, using Alaska wages and salaries[9] in the four categories as weights. The resulting two weighted averages were averaged to produce a final estimate of the ratio of value added to payroll in "other manufacturing." This ratio was multiplied by 1961-1972 Alaska "other manufacturing" wages and salaries[9] to obtain estimates of gross product for "other manufacturing" in Alaska.

Gross Product—Estimates of Factor Payments

In those industries where there was no direct information available concerning value added, the estimates of gross product were obtained by adding factor payments. Since value added in an industry is equal to the sum of all payments made to factors of production, factor payments were divided into three categories: employee compensation, indirect business taxes, and other factor payments. The sections below describe how each of these components was estimated. Employee compensation and indirect business taxes were estimated for all industries. However, other factor payments were directly estimated only for those industrial sectors not discussed above. In the industrial sectors that had gross product estimated directly, other factor payments were treated as a residual; they were equal to gross product minus employee compensation and indirect business taxes.

Employee Compensation

Employee compensation is equal to wages and salaries plus supplements. Data on employee compensation in Alaska were lacking, but Alaska wage and salary information was available[19]. This is feasible since supplements have a relatively fixed relationship to wages and salaries, the ratios of U.S. employee compensation to U.S. wages and salaries[20] for twenty-four U.S. industries were multiplied by Alaska wages and salaries for the same twenty-four industries over the period 1961-72. The resulting data were estimates of Alaska employee compensation by industry.

Accurate wage and salary information was lacking for agriculture, forestry, and fisheries, so it was impossible to develop separate estimates of employee compensation, fisheries, so it was impossible to develop separate estimates of employee compensation, indirect business tax, and other cost data in that industry. Also, in 1961 and 1962, employee compensation, indirect business tax, and other costs were only

available for total services, but not for the components of the service sector.

Estimates of Alaska indirect business taxes for each industry, 1961-1972, were derived from U.S. and Alaska data as follows:

1. Government receipts of federal and state-local indirect business taxes were derived from tables 3.1 and 3.3 of the National Income and Product Accounts of the United States, 1961-1972.[21] The percentages of total receipts allocated to federal and state-local government were calculated.

2. The above percentages were used to split total indirect business taxes for all industries, as shown in the gross product originating estimates (Table 1.22, National Income and Product Accounts of the United States, 1961-1972[21]), into federal and state-local shares. These components were then each divided by 1961-1972 wages and salaries from all private industries[21] The resulting Federal tax rates and state-local tax rates were added to obtain an average U.S. indirect business tax rate by year.

3. From the 1967 Census of Governments,[22] indirect business taxes were calculated as total taxes minus income taxes. For the years 1962-1966, table 18 in the Census of Governments yielded U.S. and Alaska total taxes and income taxes, from which U.S. and Alaska indirect business taxes were calculated. The 1962-1966 U.S. measures of indirect business taxes were divided by wages and salaries from all private industries in those years[21]. The 1962-1966 Alaska measures of indirect business taxes were divided by total private Alaska wages and salaries[9] (all industries less government) in those years. The Alaska results were divided by the U.S. result; this gave the Alaska indirect business tax rate relative to the U.S. indirect business tax rate.

4. For 1962-1966, the Alaska indirect business tax rates relative to the U.S. indirect business tax rates were multiplied by the state-local tax rates calculated in step (2) above. The resulting data were added to the 1962-1966 Federal tax rates from step (2); this yielded average Alaska indirect business tax rates. The 1962-1966 average Alaska indirect business tax rates were divided by the average U.S. tax rates. The results were adjustment factors for 1962-1966.

5. 1961-1972 data were collected on U.S. indirect business taxes[8] and wages and salaries[21] for each industry. Indirect business taxes were divided by wages and salaries to yield "industry tax rates" by year, by industry.

6. Adjustment factors were available annually for 1962-1966. For the other years, the adjustment factor was taken to be the average of the 1962-1966 adjustment factors. The appropriate adjustment factors were each multiplied by industry tax rates by year, by industry. The results were the industry tax rates for Alaska.

7. The Alaska industry tax rates were multiplied by Alaska wages and salaries[9] to obtain Alaska indirect business taxes by year, by industry.

Other Factor Payments

Other factor payments consist of capital consumption allowances, corporate profits, proprietors' income, net interest, and rental income of persons. Information on these items was not available for Alaska. However, U.S. data were available by industry for the relevant time period 1961-1972. Ratios of other factor payments to U.S. employee compensation[8] were calculated for industry components in seven industrial sectors. These ratios were multiplied by Alaska employee compensation[23] by industry by year to obtain estimates of Alaska other factor payments. Gross product in each of these industry components was then calculated as the sum of employee compensation, indirect business taxes, and other factor payments. Other factor payments were treated as a residual in eight Alaska industrial components:

1. Metal mining
2. Oil and gas
3. Other mining
4. Contract construction
5. Food and kindred products
6. Lumber and wood products
7. Paper and allied products
8. Other manufacturing

Other factor payments were obtained for these industries by subtracting employee compensation and indirect business tax from gross product.

Alaska Price Deflators

Measurement of Alaska gross product in constant dollars requires use of a price deflation method. However, there are no direct Alaska price deflators available. U.S. implicit price deflators have been calculated for major industries, and these data aided in developing Alaska data.

For the years 1961-1972, implicit price deflators, employee compensation, and employment data were collected for twenty-one U.S. industries.[20] For each industry, total employee compensation was divided by numbers employed to

writing, rough estimates of the value of catch were used to estimate gross product in 1972.

Lumber and Wood Products: U.S.[14,15] and Alaska[16,17] data were collected from the 1963 and the 1967 census on value added by manufacture of lumber and wood products. U.S. gross product estimates were also obtained from the gross product originating series.[8] For 1963 and 1967, U.S. value added estimates from the GPO series were divided by value added estimates from the U.S. census. The resulting ratios were multiplied by 1963 and 1967 value added estimates from the Alaska census. These two estimates were divided, respectively, by wages and salaries from 1963 and 1967 Alaska lumber and wood products.[9] To obtain gross product estimates for 1961-1972, the resulting two ratios were averaged, and the average ratio was multiplied by wages and salaries from 1961-1972 Alaska lumber and wood products wages and salaries.[9]

Paper and Allied Products: Alaska census data on paper and allied products were unavailable due to disclosure regulations. U.S. census data[14,15,18] for 1958, 1963, and 1967 were collected on value added and payrolls. U.S. gross product estimates were also collected from the gross product originating series[8] for those years. Value added to payroll ratios were obtained for paper and allied products. The ratios for the three years were averaged. Ratios were obtained of (GPO) value added to (census) value added in U.S. paper and allied products. These three ratios were then averaged to obtain an adjustment factor to convert census estimates to national income concepts. The two sets of averaged ratios were multiplied. The resulting ratio was multiplied by Alaska paper and allied products, wages, and salaries[9] from 1961-1972 to obtain gross product estimates for those years.

Other Manufacturing: "other manufacturing" in Alaska consists primarily of printing and publishing; chemicals; stone, clay, and glass products; machinery; and transportation equipment. Value added by manufacture for 1963 and 1967 was obtained from U.S. census data for the above four categories. U.S. gross product estimates[8] for the same years were obtained from the gross product originating series. Adjustment factors were computed as the ratios of value added (from GPO) to value added (from census) for the four categories for 1963 and 1967. Data from the Alaska census[16,17] on value added by manufacture and payroll for the four categories were obtained for 1963; data on printing and publishing only were available for 1967. The adjustment factors derived from U.S. census data were multiplied by the Alaska ratios to make the Alaska value added estimates consistent with national income concepts. Ratios of adjusted value added to payroll were calculated for the four categories. The resulting ratios were used to compute 1963 and 1967 weighted averages, using Alaska wages and salaries[9] in the four categories as weights. The resulting two weighted averages were averaged to produce a final estimate of the ratio of value added to payroll in "other manufacturing." This ratio was multiplied by 1961-1972 Alaska "other manufacturing" wages and salaries[9] to obtain estimates of gross product for "other manufacturing" in Alaska.

Gross Product—Estimates of Factor Payments

In those industries where there was no direct information available concerning value added, the estimates of gross product were obtained by adding factor payments. Since value added in an industry is equal to the sum of all payments made to factors of production, factor payments were divided into three categories: employee compensation, indirect business taxes, and other factor payments. The sections below describe how each of these components was estimated. Employee compensation and indirect business taxes were estimated for all industries. However, other factor payments were directly estimated only for those industrial sectors not discussed above. In the industrial sectors that had gross product estimated directly, other factor payments were treated as a residual; they were equal to gross product minus employee compensation and indirect business taxes.

Employee Compensation

Employee compensation is equal to wages and salaries plus supplements. Data on employee compensation in Alaska were lacking, but Alaska wage and salary information was available[19]. This is feasible since supplements have a relatively fixed relationship to wages and salaries, the ratios of U.S. employee compensation to U.S. wages and salaries[20] for twenty-four U.S. industries were multiplied by Alaska wages and salaries for the same twenty-four industries over the period 1961-72. The resulting data were estimates of Alaska employee compensation by industry.

Accurate wage and salary information was lacking for agriculture, forestry, and fisheries, so it was impossible to develop separate estimates of employee compensation, fisheries, so it was impossible to develop separate estimates of employee compensation, indirect business tax, and other cost data in that industry. Also, in 1961 and 1962, employee compensation, indirect business tax, and other costs were only

obtain average annual employee compensation. Linear regression analysis was performed on each industry over the twelve-year period, with implicit price deflators as functions of average annual employee compensation. The resulting equations are shown in the tabulation below.

Alaska employee compensation data[23] on the comparable Alaska industries were developed for the 1961-1972 period. An exception was that only employee compensation for total services was available in 1961 and 1962. For those years, the "other services" equation was used to calculate a deflator for total services. Employment data[9] were also collected by industry, by year. Total employee compensation was divided by the numbers employed to yield average annual compensation per employee. For each industry, Alaska average annual compensation per employee by year was substituted for X in the relevant regression equation. The regression equation was then used to compute Alaska price deflators, by year, for each industry.

In four industry categories: agriculture, forestry, and fisheries; metal mining; oil and gas; and air transportation the regression analysis produced unreliable results, so different procedures were used to obtain Alaska price deflators in those industries. The metal mining, oil and gas, and air transportation industries are subject to a considerable amount of price regulation. Also, in some cases, wages and salaries are a relatively small component of total value added. For these reasons, it is not too surprising that the regression analysis indicated a very weak relationship between average employee compensation and value added price deflators. Because prices tend to be determined on national markets or by national policies, the Alaska price deflators in metal mining, oil and gas, and air transportation were assumed to be the same as the U.S. price deflators.

The price deflator for agriculture, forestry, and fisheries was computed directly from data on the prices received by fishermen. It should be recalled that in Alaska, the

INDUSTRY – U.S.	REGRESSION EQUATION	r^2
Other Mining	Y = 38.521 + .0060X	.653
Contract Construction	Y = -22.381 + .0215X	.997
Food and Kindred Products	Y = 83.065 + .0046X	.804
Lumber and Wood Products	Y = 55.396 + .0099X	.904
Paper and Allied Products	Y = 71.489 + .0041X	.930
Other Manufacturing	Y = 53.301 + .0086X	.983
Trucking and Warehouse	Y = 61.919 + .0064X	.949
Water Transportation	Y = 73.962 + .0061X	.440
Other Transportation	Y = -69.166 + .0392X	.960
Communications	Y = 98.122 + .0007X	.312
Public Utilities	Y = 88.754 + .0017X	.726
Wholesale Trade	Y = 58.422 + .0063X	.941
Retail Trade	Y = 30.661 + .0202X	.947
Finance, Insurance and Real Estate	Y = 35.758 + .0125X	.968
Hotels, Motels, and Lodges	Y = -5.408 + .0343X	.948
Personal Services	Y = 29.581 + .0224X	.996
Business Services	Y = 31.662 + .0153X	.972
Medical Services	Y = 40.135 + .0221X	.984
Other Services	Y = 34.718 + .0232X	.996
Federal Government	Y = 8.121 + .0198X	.997
State and Local Government	Y = -9.058 + .0277X	.998

Y = implicit price deflator
X = average annual employee compensation
r^2 = squared multiple correlation coefficient

"agriculture, forestry, and fisheries" industry is composed almost entirely of commercial fishing. Using 1959 as a base year, since 1958 data were unavailable (the other implicit price deflators used 1958 as a base), the price per pound of salmon, halibut, king crab, and shrimp in that year was obtained.[24] These prices were multiplied by volume of catch in the years 1961-1972 for the four fish species. The results were summed for each year, yielding total value of catch of all four species by year in constant prices. Total value of catch of the four species was also obtained in current prices.[3] Then, for each year, the total value of catch in current dollars was divided by the total value of catch in constant dollars. The result was the Alaska agriculture, forestry, and fisheries price deflator.

Alaska Gross Product in Constant Dollars

Alaska gross product in constant dollars is computed by dividing each current dollar gross product by the corresponding price deflator. This calculation was carried out for the individual industrial components; estimates for industrial sectors were obtained by adding the figures for the relevant components.

Since gross product in constant dollars has been adjusted for changes in prices, it provides a measure of the change in real production activity. Current dollar gross product can increase due to a rise in prices even if real production remains constant. Constant dollar gross product will increase only if there is an increase in the output of goods and services in the Alaska economy. However, the nature of the deflation procedure is such that it is difficult to give a precise interpretation to the *level* of gross product in constant dollars. The constant dollar series is most useful as a measure of the *change* in output.

It should be noted that the price deflators use 1958 as the base year, but the implicit prices used are average U.S. prices, not Alaska prices. Thus, even in the base year, the price deflators for Alaska are greater than 100 since Alaska prices are higher than U.S. prices. In crude terms then, the constant dollar gross product series measures Alaska output valued at average U.S. 1958 prices.

NOTES

1. U.S. Department of Commerce, Bureau of Economic Analysis, Special printout sheets on Alaska personal income.
2. U.S. Department of Commerce, Bureau of the Census, *1967 Census of Commercial Fisheries.*
3. Alaska Department of Economic Development, *Statistical Review 1972.*
4. U.S. Department of Commerce, Bureau of the Census, *1963 Census of Mineral Industries, Vol. I – Summary and Industry Statistics.*
5. U.S. Department of Commerce, Bureau of the Census, *1967 Census of Mineral Industries, Vol. I—Summary and Industry Statistics.*
6. U.S. Department of Commerce, Bureau of the Census, *1963 Census of Mineral Industries, Vol. II – Area Statistics.*
7. U.S. Department of Commerce, Bureau of the Census, *1967 Census of Mineral Industries Vol. II—Area Statistics.*
8. U.S. Department of Commerce, Bureau of Economic Analysis, Special printout sheets on product account data.
9. Alaska Department of Labor, *Statistical Quarterly*, various issues.
10. These breakdowns as well as the other breakdowns used in this report are in conformance with U.S. Bureau of the Budget, Department of Commerce, *Standard Classification Manual*, 1967 edition.
11. U.S. Department of Commerce, Bureau of the Census, *1967 Census of Construction Industries, Vol. I – Industry Statistics and Special Reports.*
12. U.S. Department of Commerce, Bureau of the Census, *1967 Census of Construction Industries, Vol. II – Area Statistics.*
13. U.S. Department of Commerce, Bureau of Economic Analysis, *Survey of Current Business, July 1971*, p. 21.
14. U.S. Department of Commerce, Bureau of the Census, *1963 Census of Manufactures, Vol. I – Summary and Subject Statistics.*
15. U.S. Department of Commerce, Bureau of the Census, *1967 Census of Manufactures, Vol. I – Summary and Subject Statistics.*
16. U.S. Department of Commerce, Bureau of the Census, *1963 Census of Manufactures, Vol. II – Area Statistics.*
17. U.S. Department of Commerce, Bureau of the Census, *1967 Census of Manufactures, Vol. II – Area Statistics.*
18. U.S. Department of Commerce, Bureau of the Census, *1958 Census of Manufactures, Vol. I – Summary and Subject Statistics.*
19. Alaska, Department of Labor, *Statistical Quarterly*, various issues. *Wages and salaries for federal government—Alaska excluded military payrolls.* Personal income for federal military - Alaska, 1961-1972, was added to obtain total Alaska Federal government wages and salaries. Personal income data from U.S. Department of Commerce, *Survey of Current Business*, (various issues).

NOTES (continued)

20. U.S. Department of Commerce, Bureau of Economic Analysis, *Survey of Current Business*, various issues, and special printout sheets on product account data.
21. U.S. Department of Commerce, Bureau of Economic Analysis, *Survey of Current Business*, various issues.
22. U.S. Department of Commerce, Bureau of the Census *1967 Census of Governments, Vol. VI, topical studies - Number 5, Historical Statistics on Governmental Finances and Employment.*
23. The ratios of U.S. employee compensation to U.S. wages were multiplied by Alaska wages to obtain Alaska employee compensation. U.S. data were obtained from U.S. Department of Commerce, Bureau of Economic Analysis, *Survey of Current Business*, various issues, and special printout sheets on product account data. Alaska data were obtained from the Alaska Department of Labor, *Statistical Quarterly*, various issues. Data on wages for federal government in Alaska excluded military payrolls. Therefore, personal income estimates for military wages in Alaska were added to obtain total Alaska Federal government wages. Personal income data came from U.S. Department of Commerce, *Survey of Current Business*, various issues.
24. Alaska Department of Fish and Game, *Alaska Catch and Production*, various issues.

Gorsuch

ISER contract

Alternate Forms

offer poss alt forms
relate to goals
he should say —
no public part
these are poss goals (AF)
& this is form.
no launching of attack

Anti

① Assumptions
look at proposal
If diversification goal →
If cottage industry goal →
If regional economy →
If diversified & dispersed →

Dan'l
Alice
Swedish
experience

Will be here 333-2211

To L.A. expert

Date _____ Time ~~4:30~~ 3:00 ~~5:30~~

WHILE YOU WERE OUT $50

M Save questions

of _____

Phone Reservation for

TELEPHONED	J. McC &	PLEASE CALL	
CALLED TO SEE YOU		WILL CALL AGAIN	
WANTS TO SEE YOU		URGENT	

RETURNED YOUR CALL

employment

Message 2 singles

Prof. Doscher 7:00

Tues nite.

Chauncey

Operator

~~08-097~~ (Rev. ~~6/75~~)

ISER contract

Specify Clark as project director (or Brad).

Greg will talk to their people before

Effect of investing estimate - Univ.

1. Use Admin existing model
2. Use Univ - MAP model - needs to be developed

---

1. Alternate Structures
2. Loan programs
3. Renewable resource pilot projects
4. Revenue projection

Greg will get copy of proposal

What happens if you double rate of capital formation in renew resource?
boosting

Evaluation of Alaska Inc.

Portion consumed - saved

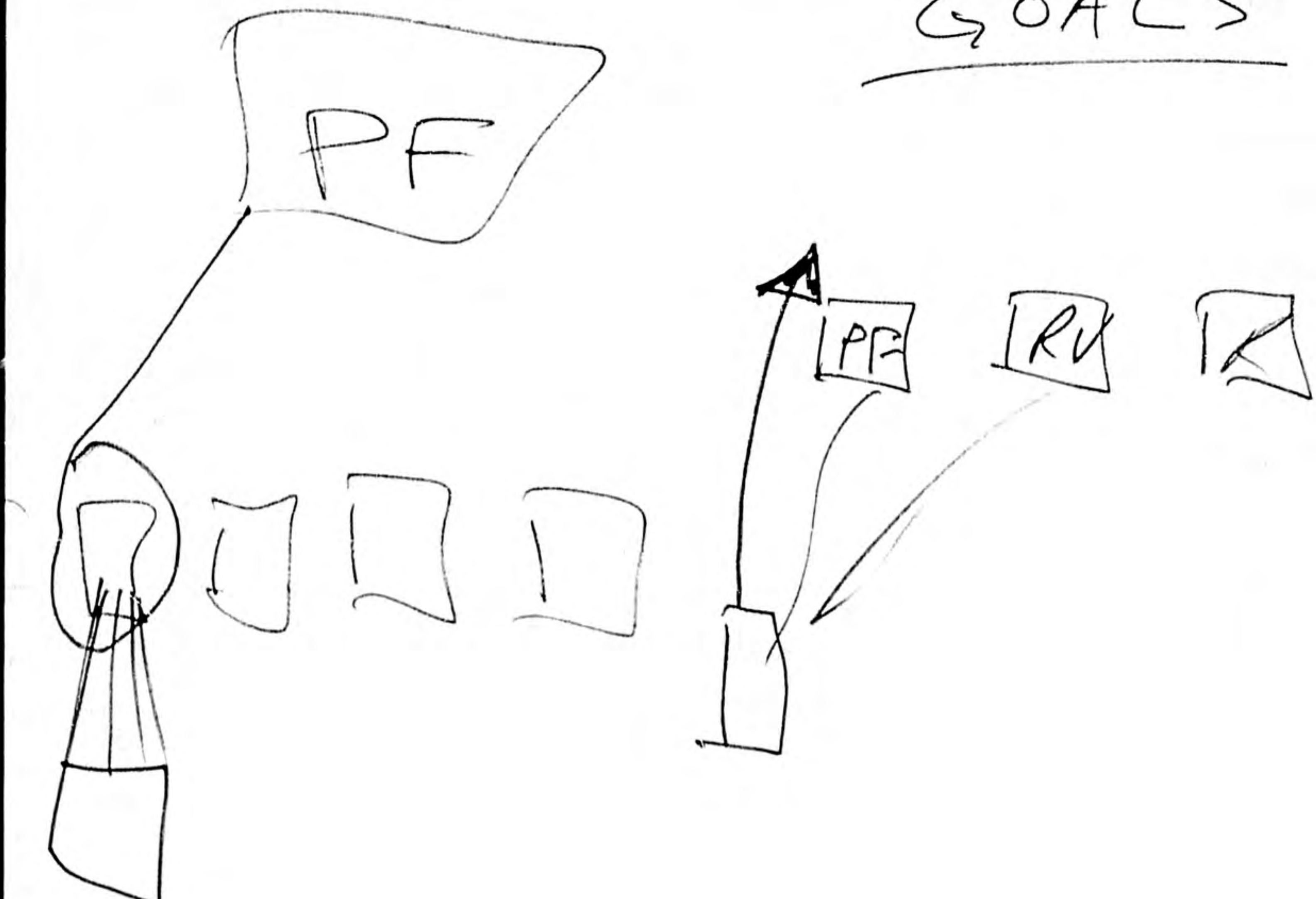
multi effect where

ISER contract

1 NRR run out
2 invest oppor run out
⇒ maximize income – high principle safety
income ⇒ fund as nest egg

investment return function

GOALS



PJ - UofA
Bill Hall - UBofA
Brad Tuck - CUP

ISER

GREGG ERICKSON

N Slope, etc

MEMO

concluded:- Dept of Revenue is
We could estimate non petroleum FY 78-79
but Revenue go good.
Petroleum (N slope) — Substantial issue
Rev coming around
Beyond 79 — what do you want to analyze?
PRESENTED to Finance. 2 wks intensive
$140 M off. Now $100 M off.
Independent estimate of all.
[Rev pt on other] ISER to provide estimates
of non-petroleum (6-7 largest) —
ind / corp, pers, mv, I-Govt, etc
At request — also proposed to analyze
feedback on structural nature of
economy & state revenues.
PENDING.
long-range projections (Rev) show thru 1985.
2nd ½ of Univ proposal. $25,000 not
adequate for fundamental - impact
Contract w/ ISER — thru Greg.
Rough draft to Greg.

ALASKA

REVIEW OF

BUSINESS AND ECONOMIC

CONDITIONS

UNIVERSITY OF ALASKA, INSTITUTE OF SOCIAL, ECONOMIC AND GOVERNMENT RESEARCH, June 1976, Vol. XIII, No. 2

AGRICULTURE IN ALASKA: 1976-2000 AD

INTRODUCTION

Sharply rising food prices and the possibility of food shortages have increasingly focused national attention on existing sources of food production and potential new areas of production in the United States. This subject is especially relevant to Alaskans who receive the largest part of their food supply by transport from the other states, and as a result pay some of the highest prices in the United States.

Just where Alaska fits into the picture as a food producer is yet undetermined. Clearly, agriculture in Alaska is small; however, it has potential for significant increases in production which could benefit Alaska, the rest of the United States, and the world.

To provide a clearer view of Alaska agriculture, its present capabilities and future possibilities, this issue of the *Review* looks at agricultural development in Alaska, analyzes past changes, and discusses future prospects for several types of agricultural production in Alaska.

Historical Development

Our knowledge of Alaska's agricultural past begins with some of the first Russian settlers who transported cattle and goats from Siberia to Kodiak Island in the latter part of the eighteenth century.[1,2] These early settlers also grew such vegetables as potatoes, cabbages, radishes, and lettuce, although with limited success because of a wet climate.

After U.S. purchase of the territory in 1867, there was little agricultural activity beyond the food that the small white populace grew for their own tables. In fact, until the first territorial governor's report in 1884, U.S. officials had been led to believe through erroneous reports that the Alaska climate effectively ruled out agriculture. Such thinking changed during the next few years, however, and by the late 1890s, the U.S. Government had established agricultural experiment stations at Sitka, Kenai, and Kodiak to conduct research toward adapting certain grains, vegetables, fruits, and livestock to Alaska conditions.[3]

The gold discovery near Nome in 1900 brought thousands of prospective miners to that area, and this new market gave a boost to a fledgling experiment in Alaska animal husbandry—reindeer. Reindeer were first imported by the U.S. Government from Siberia in the early 1890s to be used as a subsistence resource for the Natives. But when the gold rush created the nearby market, Natives and others began to sell reindeer meat to the miners. After the gold rush population subsided, reindeer in Alaska continued to

---

[1] However, some researchers believe that southeastern Natives may have cultivated tobacco in aboriginal times. See F. Laguna, *Under Mount St. Elias: The History and Culture of the Yakutat Tlingits* (Washington, D.C.: Smithsonian Institution Press, 1972), p. 410.

[2] Alford Jake Barron, "History of Agriculture in Alaska" (Thesis, University of Oklahoma, 1939), Chapter 2.

[3] *Ibid.*, Chapter 1.

ALASKA REVIEW OF BUSINESS
AND ECONOMIC CONDITIONS

VOL. XIII, No. 2
JUNE 1976

Published by the

Institute of Social, Economic and Government Research
University of Alaska
Anchorage • Fairbanks • Juneau

Robert W. Hiatt—President, University of Alaska
Lee Gorsuch—Director, ISEGR

Editor: Ronald Crowe
ISEGR, University of Alaska
Fairbanks 99701

Author: Wayne Thomas

increase, being used both for local subsistence and commercially for local as well as import markets in the United States. Reindeer herds increased steadily until they peaked in 1932 at approximately 640,000 animals. After that, for a variety of economic and other reasons, their numbers were allowed to decrease precipitously. Total numbers in 1968 were estimated at only 30,000 head.[4]

The 1902 discovery of gold in the north Tanana Valley led to development there of a significant market for agricultural products. A small agricultural industry developed in response to the growing numbers of gold seekers, and local farmers produced grains, vegetables, livestock, and poultry products. However, as gold production diminished and the boom population decreased, agricultural activity also decreased.[5]

A depression-inspired experiment in the mid-1930s renewed agricultural interest in Alaska when the U.S. Government transplanted a group of impoverished farmers from the mid-western United States to the Matanuska Valley to develop agricultural production in that region.[6] This experiment was a success to the extent that today, this valley produces the largest volume of agricultural products in the state.

During the late 1940s, the U.S. Department of Agriculture (USDA), in response to U.S. military concern for the vulnerability of Alaska's food supply, increased its efforts to make the territory less dependent on the other states. The USDA increased its agricultural research, expanding ongoing programs and introducing new ones. In addition, the military increased its purchases of locally grown products. As a result, partly of this and partly because of a growing population, Alaska agriculture grew steadily from that time until the early 1960s. By the sixties, however, because of an improving transportation network between Alaska and the lower U.S., Alaska's small scale, inefficient agriculture simply could not compete with the massive, cheaper output of its lower U.S. counterpart. Thus, agriculture in Alaska stagnated during the 1960s (Table 1).

TABLE 1

Summary of Alaska Crop and Livestock Sales 1960-1974

Year	Crops	Livestock	Total
1974	$ 1,987,000	$3,654,000	$5,641,000
1973	1,980,000	3,318,000	5,298,000
1972	1,343,000	3,040,000	4,383,000
1971	963,000	2,871,000	3,834,000
1970	903,000	3,112,000	4,015,000
1969	624,000	2,948,000	3,572,000
1968	1,031,000	3,060,000	4,091,000
1967	920,000	3,197,000	4,117,000
1966	1,025,000	3,299,000	4,324,000
1965	989,000	3,255,000	4,244,000
1964	1,332,000	3,025,000	4,357,000
1963	865,000	3,148,000	4,013,000
1962	1,139,000	3,265,000	4,404,000
1961	1,090,000	3,315,000	4,405,000
1960	1,020,000	3,116,000	4,136,000

SOURCE: Alaska Crop and Livestock Reporting Service, Palmer, Alaska

Importance of Agriculture in Alaska

If large-scale agricultural development in Alaska were feasible, it could provide food products for a world market. In addition, it could provide employment and economic development for Alaskans. World population and incomes are rising, with a corresponding increase in demand for food. Greater food production is facilitated by increased

[4] Dean F. Olson, *Alaska Reindeer Herdsmen*, Institute of Social, Economic and Government Research Report No. 18 (Fairbanks: University of Alaska, 1969), pp. 8-16.

[5] Population in the area, including Fairbanks, grew to 10,541 persons by 1910. By 1920, however, declining gold production had caused the population to dwindle to 2,182. James W. Sullivan, "Fairbanks: An Economic Profile," *Alaska Review of Business and Economic Conditions*, 7 (January 1970):1.

[6] Evangeline Atwood, *We Shall be Remembered* (Anchorage: Alaska Methodist Press, 1966).

efficiency of production and development of new agricultural lands. There are only a few places left on earth with large areas of undeveloped land, and Alaska is one of these.

Another factor to consider in measuring the importance of Alaska agriculture is, even if it were only developed to provide for markets within the state, such development would provide employment opportunities and create secondary economic growth in rural areas. A developed, large-scale agriculture, if feasible, could provide Alaska consumers with a limited range of price-competitive food products. Another advantage would be the social benefits resulting from an attractive rural lifestyle enjoyed directly by farm families and vicariously by urban residents. There are, of course, some negative aspects to consider. The character of certain wild land areas would distinctly change. Development would affect habitat for wild game and fish to the extent that whole areas might become unsuitable for certain species. Stream and ground water pollution might increase due to use of agricultural chemicals and large concentrations of people.

Thus, we must ask several questions in considering agricultural development in Alaska:

- What is the present state of agriculture in Alaska? (What base have we to build on?)
- What, if any, types of future agricultural enterprises have been identified as feasible for Alaska?
- What is the potential for statewide and export markets?
- What would be the regional economic impact of such developments?
- What would be the social benefits of agricultural development; for example, the farm lifestyle?
- What would be the social costs of agricultural development—that is, pollution potential and impact on wild lands and wildlife.

The first four questions are explored in the remaining sections of this *Review*. Although the questions on social benefits and costs will need to be considered in depth, they are outside the scope of this article.

PRESENT SITUATION

Major agricultural production areas in Alaska are shown in Figure 1.

Livestock and Poultry Products

Milk Production. Milk is the largest component of reported agricultural sales in Alaska (Table 2).

TABLE 2

Sales of Alaska Livestock and Crops, 1974

Product	Sales	Percent
Milk	$2,449,000	43
Eggs	499,000	9
Potatoes	760,000	13
Hay	754,000	13
Beef	322,000	6
Lettuce	232,000	4
Reindeer[b]	150,000	3
Other Vegetables	129,000	2
Pork	77,000	1
Barley and Oats	104,000	2
Wool	98,000	2
Poultry Meat	10,000	—[a]
Silage	8,000	—[a]
Mutton	49,000	1
TOTAL	$5,641,000	100

[a] less than 1 percent

[b] Excludes antlers, hides, and other byproducts (worth $60,000 in 1974).

SOURCE: Alaska Crop and Livestock Reporting Service, Palmer, Alaska

However, much of what is consumed in the state is imported.

According to 1972 data, fresh milk sales from Alaska producers accounted for approximately 33 percent of the total fluid milk consumed in Alaska.[7] Another 33 percent (including all the fresh milk consumed in Southeastern Alaska) was shipped in fresh. Recombined milk accounted for the remaining 33 percent of the fluid milk market. It is shipped in as a dry powder and butterfat/cream, reconstituted in Alaska, packaged much like fresh milk and sold as a competing product.[8]

Alaska's dairy industry has been undergoing a readjustment period since the 1960s. Milk sales and production remained relatively constant in the Matanuska Valley for the entire period 1960-1974

[7] Except for some ice cream items, all other dairy products, including fresh milk, are shipped into Alaska, largely from Washington State.

[8] Wayne C. Thomas and Peter C. Lin, "Economic Factors in Alaska Milk Marketing," *Agroborealis*, 4 (1972):21-22. The milk data were taken from this article and updated.

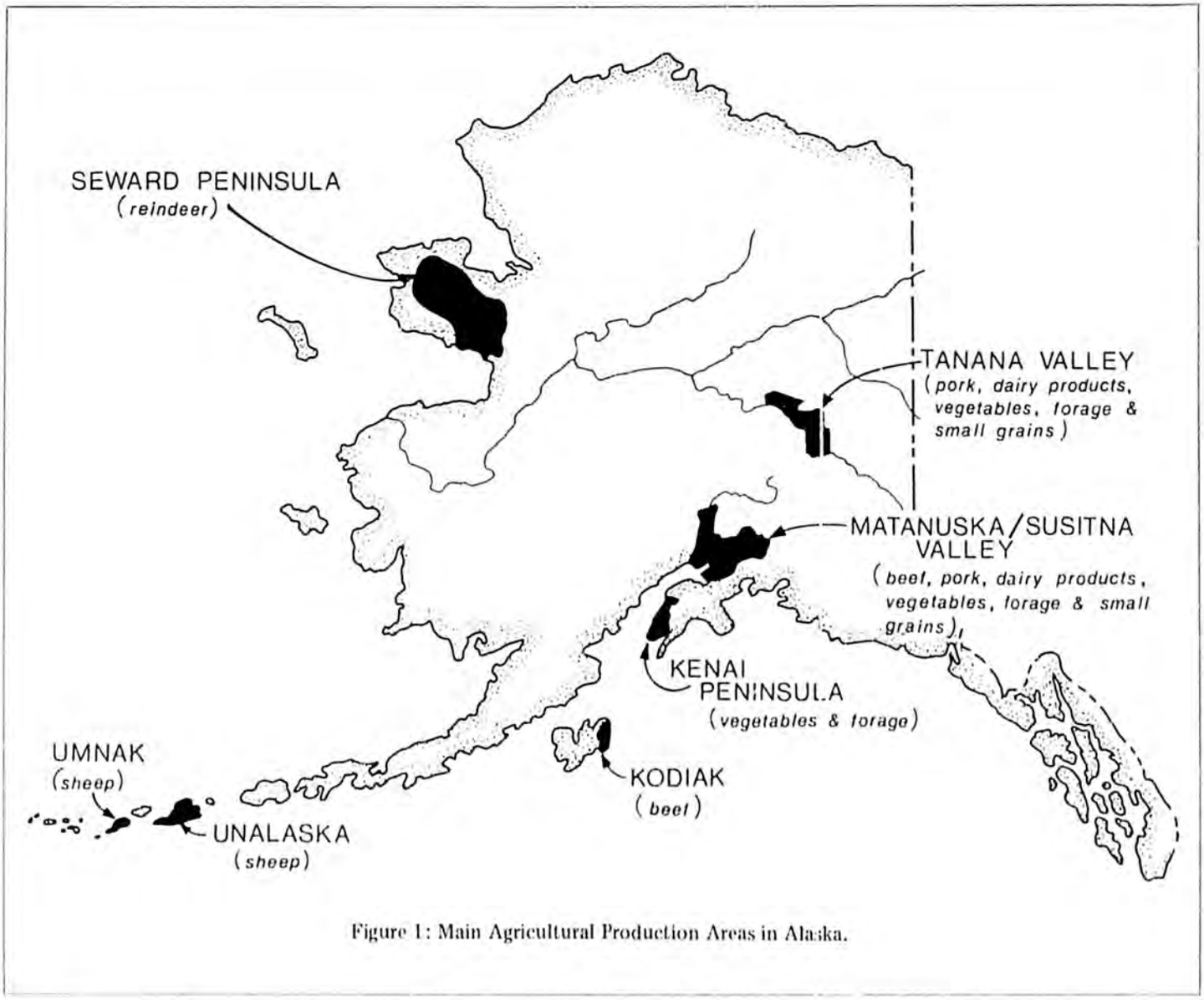


Figure 1: Main Agricultural Production Areas in Alaska.

(Table 3), while they declined rapidly in all other regions of the state. A number of factors were responsible for the reduction. The cost of milk production is relatively high in Alaska due to insufficient farm size, rising land costs, and economically more attractive alternative uses of labor and capital in the other sectors of the Alaska economy.

Beef Cattle. Cattle for slaughter come from two major sources in Alaska. One source is the Matanuska Valley dairy farms where bull calves and cull cows make up 31 percent of total beef marketings. The other source is ranches on Kodiak island, which represents the largest beef breed production area, with 48 percent of beef sales.[9] Most of the cattle slaughtered for beef in Alaska are marketed by the individual producers and sold privately as beef for frozen food lockers. At times, a small percentage goes into manufactured beef where the carcasses are ground for hamburger and other processed meats. Some cuts of Alaska beef are intermittently sold at retail in mainland Alaska on a supply-available basis.

Alaska produces less than 2 percent of the beef marketed within the state.[10] Total sales of Alaska beef in 1974 amounted to slightly less than 500,000 pounds (Table 4). As shown in Table 4, Alaska beef

[9] Alaska Livestock and Crop Reporting Service, *Alaska Agricultural Statistics*, various issues.

[10] Christopher Stephens, Wayne Thomas, and Virginia Burke, *Supplying Alaska's Red Meat and Poultry Markets*, Institute of Agricultural Sciences Bulletin 41 (Fairbanks: University of Alaska, May 1975), p. 23.

TABLE 3

Quantity Sold, Value of Sales, and Price Received for Milk Produced in Alaska 1960-1974

Year	Tanana Valley		Matanuska Valley		Kenai Peninsula		Southeast		Totals		Price/cwt.[b]
	Quantity (lbs x 10^3)[a]	Sales (x 10^3)	Quantity (lbs x 10^3)	Sales (x 10^3)	Quantity (lbs x 10^3)	Sales (x 10^3)	Quantity (lbs x 10^3)	Sales (x 10^3)	Quantity (lbs x 10^3)	Sales (x 10^3)	
1974	645	$ 92	16,555	$2,357	–	$–	–	$–	17,200	$2,449	$14.24
1973	650	85	16,650	2,022					17,300	2,107	12.18
1972	800	135	16,100	1,828	–	–	–	–	16,900	1,963	11.62
1971	830	91	15,570	1,747	–	–	–	–	16,500	1,838	11.21
1970	950	141	16,850	1,853	–	–	–	–	17,800	1,994	11.20
1969	625	95	16,250	1,751	115	14	10	2	17,000	1,862	10.95
1968	470	65	16,400	1,726	120	14	10	2	17,000	1,807	10.63
1967	969	115	16,496	1,736	125	14	10	2	17,600	1,867	10.61
1966	1,700	168	16,430	1,684	120	21	50	8	18,300	1,881	10.28
1965	1,850	215	16,345	1,593	647	59	858	87	19,700	1,954	9.92
1964	1,520	184	18,280	1,720	640	60	1,060	103	21,500	2,067	9.61
1963	2,160	294	17,940	1,783	674	71	1,326	136	21,900	2,284	10.43
1962	2,420	323	17,760	1,817	460	51	1,360	149	22,000	2,340	10.64
1961	2,430	340	17,700	1,975	240	25	1,430	164	21,800	2,504	11.49
1960	2,170	308	15,504	1,763	221	25	1,505	181	19,400	2,277	11.74

[a] 10^3 = 1,000

[b] cwt = hundredweight

SOURCE: Alaska Crop and Livestock Reporting Service, Palmer, Alaska

TABLE 4

Quantity Sold, Value of Sales, and Price Received for Various Meat Products Produced in Alaska 1960-1974

Year	Beef and Veal			Pork			Lamb and Mutton			Reindeer		
	Quantity Sold D.W.[a] (lbs x 10^3)[b]	Sales (x 10^3)	Price/ cwt D.W.	Quantity Sold D.W. (lbs x 10^3)	Sales (x 10^3)	Price/ cwt D.W.	Quantity Sold D.W. (lbs x 10^3)	Sales (x 10^3)	Price/ cwt D.W.	Quantity Sold D.W. (lbs x 10^3)	Sales (x 10^3)	Price/ cwt D.W.
1974	466	322	69.10	136	77	56.62	102	$49	48.04	220	$150	$68.18
1973	420	309	73.57	110	71	64.55	20	9	45.00	261	144	55.17
1972	483	$278	$57.56	124	$79	$63.71	20	9	45.00	239	121	50.63
1971	494	273	55.26	138	88	63.77	21	10	47.61	365	188	51.51
1970	681	355	52.13	123	75	60.98	33	17	51.53	479	241	50.31
1969	719	359	49.93	142	64	45.07	17	9	52.94	442	219	47.82
1968	692	292	42.20	191	83	43.46	19	11	57.89	608	260	42.76
1967	857	350	40.84	140	64	45.71	28	12	42.86	517	188	36.36
1966	854	350	40.98	145	77	53.10	34	14	41.18	546	190	34.80
1965	694	279	40.20	198	98	45.96	21	9	42.86	522	200	38.31
1964	624	249	39.58	128	51	39.84	16	8	50.00	504	195	38.69
1963	505	209	41.39	64	24	37.50	15	8	53.33	394	138	35.03
1962	507	237	46.75	121	51	42.15	14	8	57.14	372	139	37.37
1961	251	116	46.22	166	67	40.36	13	7	53.84	364	136	37.36
1960	305	122	40.00	145	59	40.69	9	5	55.55	330	132	40.00

[a] D.W. = Dress weight

[b] 10^3 = 1,000

SOURCE: Alaska Crop and Livestock Reporting Service, Palmer, Alaska

production for the period 1960-1974 has fallen from its highest production level in 1967. Part of reduced beef production in Alaska was due to unsettled Native land claims. Until land titles become less clouded, existing beef producers, especially those operating on leased federal lands, are probably reluctant to make the major capital investments necessary to maintain or increase production.

Hogs. In 1972, over 6,000,000 pounds of cured and uncured pork (42,000 carcasses) were shipped to Southcentral Alaska.[11] In the same year, less than 800 carcasses were produced in the state. Alaska pork, unlike Alaska beef, can move into any existing market, because it is similar in all respects to shipped-in pork products. However, local pork production can only expand significantly if the higher costs of production in Alaska are no greater than cost of pork in the lower 48 states plus transportation to Alaska. A 1971 study indicates that a production cost range of $28.66 to $36.25 per hundredweight (dressed weight) can be achieved in Alaska with good-to-average management.[12]

Since 1965, Alaska farm-level pork prices have not dropped below $37.50 per hundredweight (dressed weight). Thus, increased pork production, if managed properly, should be profitable in Alaska.

Pork production through 1974 remained below that of 1965 (Table 4). In 1974, several pork producers in the Matanuska and Tanana valleys went out of business, both because of a lack of local feed and a lack of the processing facilities and other supporting services.

Sheep and Wool. Alaska sheep production occurs almost exclusively on the eastern portion of the Aleutian Islands. The production process is dissimilar to what is generally found in the western range areas of the lower states, because lamb production for meat is not the primary income generator. All lambs, both wethers and ewes, are kept for wool production. Only as the animals grow older and their wool production declines are they sold for mutton, generally to individual buyers (Table 4).

In 1974, a significant increase in mutton production occurred in the Aleutian Islands after a new slaughter house went into operation on Umnak Island. This mutton was sold to institutional buyers from the lower United States.

The wool is also sold to markets in the lower states. Production of wool in Alaska has diminished in recent years, largely because of reduced national wool prices. In 1973 and 1974, the price received locally for wool increased fourfold over 1971 (Table 5), but production of wool in Alaska has continued to decline.

Eggs and Poultry. Egg markets in Alaska have fluctuated periodically since statehood. The current production level is greater than that of 1960, but less than that of 1965-1968 (Table 6). The farm price received for eggs showed little response to inflation; it was only seven cents per dozen higher in 1974 than in 1960.

Egg production is carried on by a few large operators. There are presently two commercial-size egg producers in Alaska and both are importing most of their feed. A locally developed feed base would reduce feed supply problems.

Poultry meat production in Alaska is primarily a byproduct of egg production, providing a means of getting rid of older birds.

Reindeer. By federal law, reindeer in Alaska are entirely owned and managed by Native herders. Most of the animals are located on the Seward Peninsula and Nunivak Island. Roundup and slaughter generally occur in the fall of the year. Most slaughter animals are marketed and consumed in Nome and in Native villages in northwest Alaska. Only a limited amount of reindeer meat on a supply available basis is marketed in Anchorage or Fairbanks. In addition, a small portion is shipped outside the state for use in the exotic meat trade.

The price received by reindeer herders has nearly doubled over that of the low year 1966, while production has fallen to its lowest level in the fifteen years of data reported in Table 4.

Herd management over vast areas in the arctic and subarctic north is difficult at best. Disease and predator problems along with range management and supply problems hinder herd management. The Native lifestyle, to a degree, prevents reindeer production from achieving market potentials.[13] In addition, federal and state laws controlling methods of slaughter also hinder market growth in urban Alaska.

Crops

Hay and Silage. Hay and silage are forage crops produced to feed livestock. Dairy cows and horses

[11] *Ibid.*

[12] Wayne Burton, *Alaska Agriculture*, Institute of Social, Economic and Government Research Report No. 30 (Fairbanks: University of Alaska, 1971), p. 181. These cost figures have increased through 1975, as has the price for hogs.

[13] D. Olson, *Alaska Reindeer Herdsman*, Chapter 8.

TABLE 5

Production, Value of Sales, and Price Received for Alaska Wool 1960-1974

Year	No. of Sheep Shorn	Wool Production (pounds)	Sales	Price per pound
1974	11,000	110,000	$ 98,000	$0.89
1973	11,000	129,000	115,000	0.89
1972	13,000	145,000	55,000	0.38
1971	16,000	225,000	43,000	0.19
1970	21,000	239,000	72,000	0.30
1969	23,000	269,000	94,000	0.35
1968	23,000	264,000	92,000	0.35
1967	21,000	246,000	98,000	0.40
1966	19,000	215,000	123,000	0.57
1965	18,000	209,000	111,000	0.53
1964	16,000	189,000	115,000	0.61
1963	14,000	167,000	97,000	0.58
1962	12,000	146,000	72,000	0.49
1961	12,000	128,000	51,000	0.40
1960	11,000	125,000	50,000	0.40

SOURCE: Alaska Crop and Livestock Reporting Service, Palmer, Alaska

constitute the primary markets for Alaska hay. This crop is so important that milk production in the Matanuska Valley has to some degree fluctuated according to hay productivity. A reduction in milk production in 1971 can be partially explained by the smaller hay crop that year. In 1972, 1973, and 1974, the Matanuska Valley, in response to favorable climatic and economic conditions, produced the largest hay crops in its history.[14]

In 1974, hay produced in Alaska was worth approximately $2,000,000. Of this, 39 percent or $754,000 came from off-farm sales to Alaska horse owners (Table 7). Pleasure and work horses in Alaska in 1971 numbered nearly 3,000 head.[15] Although data are not available, the number of horses would appear to be increasing in Alaska in conjunction with the population growth. If this is true, the demand by horse owners for roughage should continue to be strong, thereby increasing demand for hay.

The other important forage crop, silage, can be

[14] However, Alaska milk sales did not follow the upward trend of hay production for the period 1972-74.

[15] *Alaska Agricultural Statistics*, various issues.

TABLE 6

Production and Value of Sales for Alaska Eggs and Poultry Meat 1960-1974

Year	Eggs Sold (dozen)	Sales (dozen)	Farm Price per dozen	Poultry Meat Sales
1974	525,000	$499,000	$0.95	$10,000
1973	575,000	546,000	0.95	17,000
1972	576,000	518,000	0.90	17,000
1971	492,000	418,000	0.85	13,000
1970	408,000	341,000	0.84	17,000
1969	425,000	328,000	0.77	13,000
1968	617,000	496,000	0.80	19,000
1967	750,000	592,000	0.79	26,000
1966	842,000	648,000	0.77	16,000
1965	758,000	584,000	0.77	20,000
1964	408,000	328,000	0.80	14,000
1963	458,000	369,000	0.81	19,000
1962	493,000	400,000	0.81	18,000
1961	526,000	410,000	0.80	24,000
1960	518,000	454,000	0.88	17,000

SOURCE: Alaska Crop and Livestock Reporting Service, Palmer, Alaska

produced from the same crop, grass or grain, as can hay. Determination of which harvest method to use depends on market, weather, crop, and storage conditions, as well as on feed and labor requirements of individual farms. In 1974, over 98 percent of the silage produced was used on the producing farms (Table 8).

Barley and Oats. Barley is used for cattle, hog, chicken, and horse feed. More barley was sold in 1973 than any year since 1960 (Table 9). However, in 1974, one large farming operation switched from barley to straw production (for pipeline construction), and the quantity of barley produced in the state decreased dramatically. This feed base instability has a detrimental effect on livestock production in Alaska.

Oats is the other feed grain grown commercially in Alaska. Oats production dropped from around 1,000 acres annually in the early 1960s to 500 acres in 1974 (Table 10). This crop is used for horse and dairy feed.

Potatoes. The Matanuska Valley accounts for 87 percent of the potatoes harvested in the state. The remainder comes from the Tanana Valley, with a small portion also produced on the Kenai Peninsula. Potato production in Alaska is highly mechanized with hired labor needed only for harvesting. After harvest, potatoes can be stored by the producer until the next harvest period. This allows for a more continuous market supply and helps to prevent short-term market gluts which drive down the farm price.

Potato acreage fell to near its lowest level in 1974 (for period 1960-1974), while price received was more than double that of 1967 (Table 11).

Alaska-grown potatoes are commonly found in food stores throughout the state. However, a lack of potato-processing facilities in Alaska has limited the product to only the fresh market.

Several attempts, yet unsuccessful, have been made to develop frozen-food processing facilities in the Matanuska Valley. Until this occurs, both civilian and military markets will continue to look outside the state for frozen and dry-processed potatoes.

Vegetables

Lettuce. In 1974, lettuce had the largest dollar

TABLE 7

Production, Value of Sales, and Sale Price Received for Alaska Hay 1960-1974

Year	Harvested Acres	Yield Per Acre (tons)	Quantity Produced (tons)	Production Value	Quantity Sold (tons)	Sales	Price per ton
1974	12,600	1.19	15,000	$1,950,000	5,800	$754,000	$130.00
1973	11,600	1.28	14,800	1,332,000	4,400	396,000	90.00
1972	10,900	1.33	14,500	1,160,000	4,200	336,000	80.00
1971	7,000	1.03	7,200	576,000	1,500	120,000	80.00
1970	8,000	1.17	9,400	705,000	1,700	128,000	75.29
1969	8,100	.95	7,700	539,000	1,600	112,000	70.00
1968	7,900	1.25	9,900	545,000	2,200	121,000	55.00
1967	8,700	1.51	13,100	721,000	1,800	99,000	55.00
1966	8,200	1.38	11,300	655,000	3,200	186,000	58.12
1965	6,900	1.28	8,800	528,000	2,200	132,000	60.00
1964	8,300	1.30	10,800	626,000	1,800	104,000	57.78
1963	7,600	1.25	9,500	551,000	1,000	58,000	58.00
1962	7,800	1.37	10,700	674,000	3,200	202,000	63.12
1961	7,400	1.34	9,900	653,000	3,100	205,000	66.13
1960	6,900	1.52	10,500	772,000	1,300	96,000	73.85

SOURCE: Alaska Crop and Livestock Reporting Service, Palmer, Alaska

TABLE 8
Production, Value of Sales, and Price Received for Alaska Silage 1960-1974

Year	Harvested Acres	Yield Per Acre (tons)	Quantity Produced (tons)	Production Value	Quantity Sold (tons)	Sales	Price per ton
1974	2,800	4.46	12,500	$500,000	200	$8,000	$40.00
1973	2,900	4.41	12,800	320,000	700	18,000	25.71
1972	3,800	5.08	19,300	367,000	500	10,000	20.00
1971	4,200	4.64	19,500	351,000	200	4,000	20.00
1970	2,900	4.69	13,600	245,000	800	14,000	17.50
1969	3,000	3.40	10,200	184,000	700	13,000	18.57
1968	3,500	5.26	18,400	276,000	400	6,000	15.00
1967	3,800	5.13	19,500	312,000	500	8,000	16.00
1966	3,900	4.69	18,300	329,000	200	4,000	20.00
1965	4,300	5.05	21,700	412,000	500	10,000	20.00
1964	5,600	5.21	29,200	540,000	1,500	28,000	18.67
1963	6,600	4.86	32,100	594,000	1,600	30,000	18.75
1962	6,500	4.03	26,200	498,000	900	17,000	18.89
1961	4,700	4.70	22,100	464,000	800	17,000	21.25
1960	4,400	4.59	20,200	411,000	80	1,600	20.00

SOURCE: Alaska Crop and Livestock Reporting Service, Palmer, Alaska

TABLE 9
Production, Value of Sales, and Price Received for Alaska Barley (produced for grain) 1960-1974

Year	Harvested Acres	Quantity Produced (cwt)[a]	Production Value	Quantity Sold (cwt)	Sales	Price/cwt.
1974	1,000	13,400	$116,000	7,400	$ 64,000	$8.65
1973	3,100	48,400	363,000	39,700	298,000	7.51
1972	2,800	24,900	101,000	13,200	54,000	4.09
1971	3,100	21,600	83,000	6,300	24,000	3.81
1970	1,500	22,300	88,000	6,800	27,000	3.97
1969	1,200	14,400	53,000	4,500	16,000	3.56
1968	1,900	27,400	117,000	12,000	51,000	4.25
1967	1,800	36,300	144,000	16,000	63,000	3.94
1966	1,600	34,600	140,000	22,100	90,000	4.07
1965	1,600	32,300	131,000	14,800	60,000	4.05
1964	1,900	35,600	144,000	19,600	80,000	4.08
1963	2,200	31,700	135,000	18,000	77,000	4.28
1962	2,200	40,100	176,000	18,000	79,000	4.39
1961	2,000	35,000	172,000	21,400	105,000	4.91
1960	2,300	42,000	192,000	16,800	77,000	4.58

[a] cwt = hundredweight
SOURCE: Alaska Crop and Livestock Reporting Service, Palmer, Alaska

TABLE 10

Production Value of Sales, and Price Received for Alaska Oats (produced for grain) 1960-1974

Year	Harvested Acres	Quantity Produced (cwt)[a]	Production Value	Quantity Sold (cwt)	Sales	Price/cwt.
1974	500	5,900	$50,000	4,700	$40,000	$8.51
1973	600	8,100	58,000	5,600	40,000	7.14
1972	500	4,800	21,000	3,400	15,000	4.41
1971	200	3,800	17,000	2,300	10,000	4.35
1970	500	7,200	29,000	2,500	10,000	4.00
1969	500	4,800	17,000	2,700	10,000	3.70
1968	900	15,000	68,000	10,000	46,000	4.60
1967	600	14,800	62,000	10,300	44,000	4.27
1966	400	10,200	42,000	6,800	28,000	4.12
1965	600	13,400	57,000	5,800	24,000	4.14
1964	500	12,000	53,000	6,600	29,000	4.39
1963	1,000	14,400	65,000	8,400	38,000	4.52
1962	1,100	21,500	97,000	7,900	36,000	4.56
1961	900	14,700	71,000	3,200	16,000	5.00
1960	1,400	25,500	120,000	8,400	39,000	4.64

[a]cwt = hundredweight

SOURCE: Alaska Crop and Livestock Reporting Service, Palmer, Alaska

TABLE 11

Harvested Acres, Quantity Sold, Value of Sales, and Price Received for Alaska Potatoes 1960-1974

Year	Harvested Acres	Quantity Sold (cwt)[a]	Sales	Price/cwt
1974	570	72,400	$760,000	$10.50
1973	500	82,500	949,000	11.50
1972	550	69,300	658,000	9.49
1971	630	71,700	502,000	7.00
1970	610	72,800	480,000	6.59
1969	620	56,100	297,000	5.29
1968	620	94,400	538,000	5.70
1967	690	108,000	502,000	4.65
1966	710	93,700	520,000	5.55
1965	780	100,100	578,000	5.77
1964	730	120,000	889,000	7.41
1963	760	107,400	467,000	4.35
1962	730	120,000	576,000	4.80
1961	770	103,400	651,000	6.30
1960	730	96,000	614,000	6.40

[a]cwt = hundredweight

SOURCE: Alaska Crop and Livestock Reporting Service, Palmer, Alaska

sales of any year since Alaska statehood. Lettuce acreage peaked in 1968 and has not since attained these levels (Table 12). A serious problem of perishability limits field production of lettuce for the Alaska market. Only one field crop of lettuce is possible during Alaska's short growing season. This is harvested between July and September, and the crop cannot be stored for any length of time. This means the market season is short and market glut problems are always a possibility.

Field Vegetable Crops. Field production of carrots, cabbage, radishes, celery, and broccoli amounted to 90 acres in 1974, a reduction of 115 acres from 1968 (Table 13). The decline has resulted from extensive labor and management problems and the high requirements for capital investment.

Controlled Environment Agriculture. Tomatoes and ornamentals are produced in Alaska on a limited basis. Production takes place in greenhouses on the Kenai Peninsula, in Southcentral Alaska, and in the Tanana Valley. Since these greenhouses can operate for longer periods (up to year-round), and the production process is faster than for field-grown varieties, crops can be marketed at different times during the year. Greenhouse production, as compared to field production, requires higher input costs and

TABLE 12

Harvested Acres, Quantity Sold, Value of Sales, and Price Received for Alaska Lettuce 1960-1974

Year	Harvested Acres	Quantity Sold (pounds)	Sales	Price/cwt[a]
1974	65	860,000	$232,000	$26.98
1973	65	600,000	142,000	23.67
1972	60	580,000	143,000	24.66
1971	75	930,000	223,000	23.98
1970	60	770,000	157,000	20.39
1969	60	510,000	62,000	12.16
1968	80	910,000	115,000	12.64
1967	60	720,000	100,000	13.89
1966	60	600,000	93,000	15.50
1965	50	620,000	95,000	15.32
1964	50	690,000	95,000	13.77
1963	60	790,000	72,000	9.11
1962	50	780,000	111,000	14.23
1961	50	670,000	85,000	12.69
1960	50	610,000	77,000	12.62

[a]cwt = hundredweight

SOURCE: Alaska Crop and Livestock Reporting Service, Palmer, Alaska

results in increased production per square foot of growing space.

Controlled environment agricultural production can go beyond greenhouse production in that all the light is artificially supplied and greater control is exerted on the growth process.[16] Experimentally, this method has shown substantially increased yields over greenhouse and field production.

Practical applications of controlled environment production are now being attempted in several locations around the world, including Alaska's Kenai Peninsula. Should the Alaska venture prove economically successful, the quantity and quality of local produce available to the Alaska consumer should increase markedly.

[16] Donald Dinkel, et al., "Controlled Environment Agriculture," *Agroborealis* 5 (1973):6-8.

FEASIBILITY STUDIES

Regions

The basis for agricultural feasibility and development is land[17] (see Appendix). In March 1974, a group of studies was published under the title of "Alaska's Agricultural Potential,"[18] which included a report by the Soil Conservation Service, U.S. Department of Agriculture. This report stated that over 15,000,000 acres in Alaska were suitable for cultivated agricultural production (this figure has since been increased to over 17,000,000 acres). To achieve a better understanding of where these soils are located, an enclosed map (Figure 2) and Table 14 contain regional districts[19] as recognized by the

[17] Greenhouse and associated methods are excluded from this analysis, because these types of production do not require extensive quantities of land.

[18] Alaska Rural Development Council, *Alaska's Agricultural Potential*, Publication No. 1 (1974), p. 19-20.

[19] Wayne Burton, *Defining Parameters of Agricultural Potential in Alaska*, Institute of Agricultural Sciences Bulletin No. 44 (Fairbanks: University of Alaska, 1975), pp. 3 and 4.

TABLE 13

Harvested Acres and Value of Sales for Alaska Carrots, Cabbage, Radishes, Celery 1960-1974

Year	Harvested Acres	Sales
1974	90	$129,000
1973	100	119,000
1972	110	127,000
1971	130	80,000
1970	140	87,000
1969	190	114,000
1968	205	154,000
1967	120	104,000
1966	95	104,000
1965	95	90,000
1964	105	107,000
1963	125	123,000
1962	105	118,000
1961	100	111,000
1960	130	115,000

SOURCE: Alaska Crop and Livestock Reporting Service, Palmer, Alaska

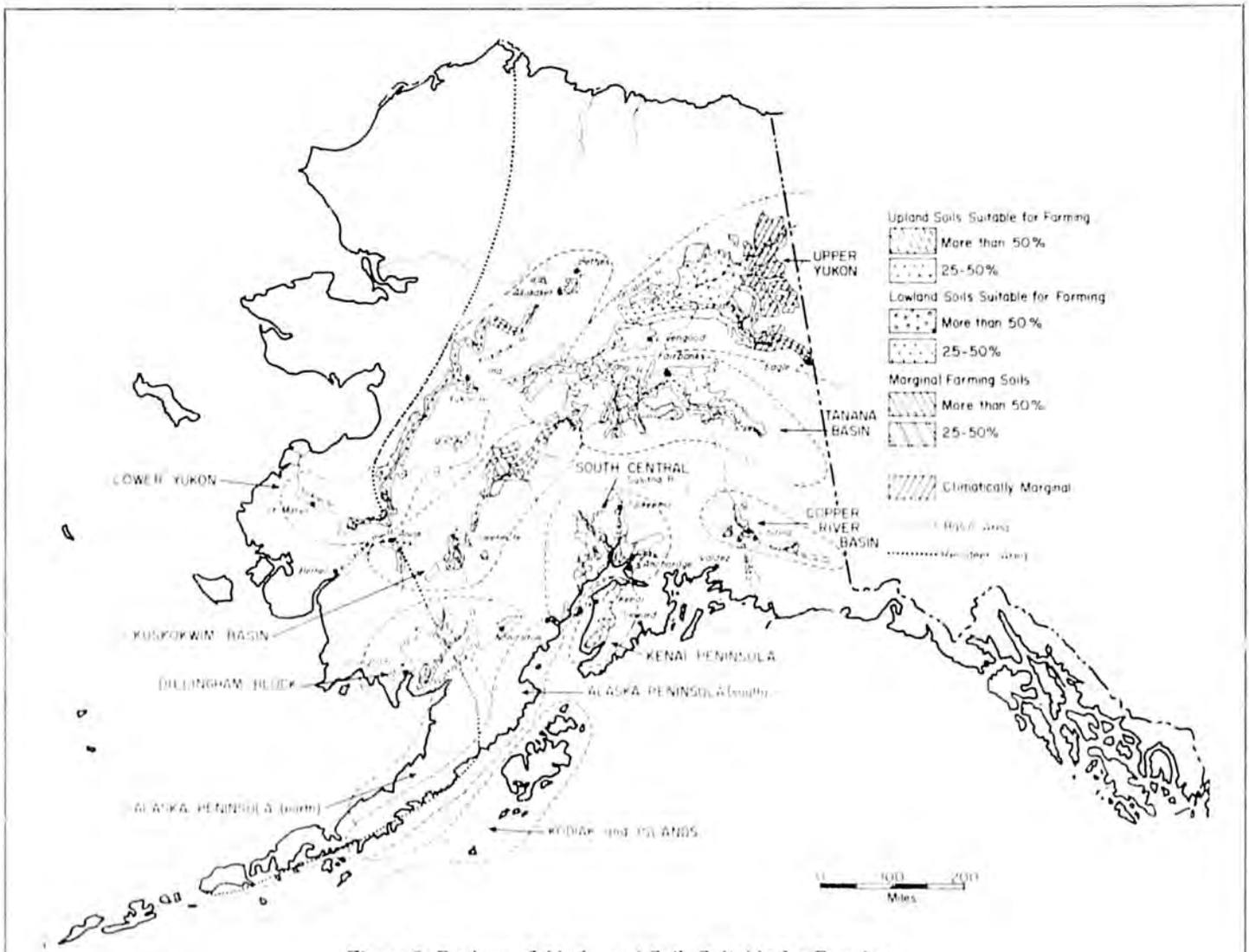


Figure 2: Regions of Alaska and Soils Suitable for Farming.

SOURCE: Wayne Burton, *Defining Parameters of Agricultural Potential in Alaska*, Institute of Agricultural Sciences Bulletin No. 44, (Fairbanks: University of Alaska, 1975).

Federal-State Land-Use Planning Commission for Alaska.[20]

Yukon Basin. The largest amount of the class 1 and 2 soils[21] in Alaska are in the Upper Yukon Basin. These are mostly located in the Yukon Flats, a major water fowl nesting area.[22] Prior to the construction of the trans-Alaska Oil Pipeline, the Upper Yukon was one of the most isolated areas in the state. The human population was small, and year-round transportation was limited to air, although water transportation was available during the summer. The pipeline road, when (or if) opened, will provide the first year-round surface access to the region. As (if) a secondary road network develops in conjunction with the pipeline road, the region will become much more accessible, and movement of commodities into and out of the region will be enhanced.

Tanana Basin. The other major area with soils suitable for agriculture is the Tanana Basin. This region already has a developed transportation system

[20] Federal-State Land-Use Planning Commission for Alaska, *Resources of Alaska: A Regional Summary* (1975).

[21] Soils are divided into group and capability class for agricultural use. Group A and B soils have properties that make them suitable for crop production. Group C tends to be more susceptible to drought, has greater erosion potential, and tends to have more slope problems. Soil capability classification (1 through 6) considers both properties and slope, which are related to soil damage during use.

[22] FSLUP, *Resources of Alaska*, p. 283.

TABLE 14

Estimated Lands Available in Alaska for Agriculture (Thousands of Acres)

Region	Class 1 (Group A)	Class 2 (Group A)	Class 3 (Group B)	Class 4 (Group B)	Class 5 (Group C)	Class 6 (Group C)	Range	Total
Upper Yukon Basin	1,626	1,571	1,625	724	--	--	a	5,546
Lower Yukon Basin	--	233	--	1,372	75	232	a	1,912
Tanana Basin	311	1,915	--	610	480	--	a	3,316
South Central	1,247	--	--	116	--	409	1,134	2,907
Kenai Peninsula	545	--	--	--	--	237	210	992
Alaska Peninsula, S.	--	--	--	--	--	--	2,233	2,233
Dillingham Block	--	883	--	138	102	--	2,096	3,219
Alaska Peninsula, N.	--	--	--	--	345	674	1,163	2,182
Kuskokwim Basin	--	406	355	355	189	426	a	1,731
Copper River Basin	153	--	--	14	15	104	a	286
Kodiak and Islands	--	--	b	b	b	b	1,200	1,200
Reindeer Grazing Areas	--	--	--	--	--	--	100,000	100,000 [c]
TOTAL	3,882	5,008	1,980	3,329	1,206	2,082	108,036	125,524

[a] No grazing lands were identified or included in calculations because of possible conflict with wildlife or other environmental factors.

[b] Not available.

[c] Estimates include only traditional reindeer grazing areas.

SOURCE: USDA-SCS field notes adjusted by Federal-State Land Use Planning Commission work group. This is Table 1 in Wayne Burton, *Defining Parameters of Agricultural Potential in Alaska*, Institute of Agricultural Sciences Bulletin No. 44, (Fairbanks: University of Alaska, 1975).

which includes all modes: air, water, rail, and road. One area near Nenana has also been identified as having good agricultural potential, but it is limited by lack of a secondary road system.

Grain and hay farms have recently been organized in the Delta-Clearwater area of the Tanana Basin, approximately 100 miles southeast of Fairbanks. A land base of sufficient size is also present to provide for further extensive development. This area already has a primary and secondary road system and is located near the Alaska Highway.

Other Areas. The South Central and Kenai Peninsula areas have good transportation networks and are easily accessible to the Anchorage market. These regions have significantly less cultivable lands than the Upper Yukon and Tanana valleys, but they enjoy locational advantages because of their nearness to the population base of the state and tidewater ports. The remaining areas (Lower Yukon, Alaska Peninsula, Dillingham, Kuskokwim, Kodiak and the Aleutians) are either islands off the coast or are isolated from the road network of the state. These all contain lesser amounts of tillable agricultural lands, although significant livestock (including reindeer) range lands are present (Table 14).

Previous Studies

In 1969, average farm cost of production per acre was significantly higher in Alaska than it was in the other states ($124.69 per acre compared with $49).[23] Some of this difference results from the

[23] U.S. Department of Commerce, Bureau of the Census, *Census of Agriculture, 1969* (1972).

higher costs of doing business in Alaska, but a significant part is caused by individual farming operations that are too small to realize the economies of scale enjoyed by farmers in the other states. The reason for small operations here is that farm land in Alaska had its origin either in homesteading or other government programs, such as the Matanuska Valley colony program of the 1930s.[24] These programs tended to place small acreages (160 acres or less) in the hands of individual farmers.

According to a 1970 study[25] that cited 1967 statistics, average farm size for the Matanuska-Susitna region was only 79 acres. Farming operations were based largely on dairy enterprises. The report suggested that high production costs in the region were due in part to the small size of the farming operations and their resulting inefficiency. The report also developed budgets for dairy, grain, and potato enterprises and included both explicit costs of operations (such variable input expenses as labor, fertilizer, etc., and interest charges on loans) as well as implicit farm costs (such as payments to operator labor, management, and owner equity). The budget analysis of grade A dairy and grain farms showed that both explicit and implicit costs of operations were not covered until farm size approached 280 acres for dairy and 320 acres for grain. For potato farming, however, a land area of only 30 acres was needed to cover all costs of production.

Given this budget analysis (even though it is ten years old) and the continuing small sizes of Matanuska farms, it is not surprising that agricultural production and sales in that region have shown little change over the period 1967-74.[26]

Agriculture in the Matanuska Valley has a significant advantage over other areas of the state, because it contains the most sophisticated market infrastructure. It has farm supply and service dealers, milk-processing facilities, a well-organized transportation system, and an easily accessible market. Its major drawbacks are the insufficient size of individual farms and highly speculative land values.

To gain a more complete view of agricultural potential in Alaska requires consideration of lands beyond the Matanuska-Susitna area. A 1967 study by the U.S. Bureau of Reclamation[27] centered on livestock production. The results indicated only limited prospects for a finished beef industry on the Kenai Peninsula, Kodiak Island, and the Aleutian Islands.

The study considered an integrated system with feed produced in the region and with cattle produced both locally and shipped in. Budgets were constructed for (1) cow-calf operations on Kodiak and adjacent islands, (2) "stocker" cattle operations that primarily used cattle imported from outside the state, and (3) a cattle feed-lot finishing operation. In all cases (except for a slaughter house) revenues were insufficient to cover explicit and implicit costs of operations. An important aspect of this study was concentration on the USDA choice retail market in Anchorage which requires significant quantities of grain to bring cattle to finished weights. This tends to reduce the advantage of the large amounts of natural grass lands found in Alaska. A subsequent study indicated that a large market for grass-fed cattle (using only limited quantities of grain) is currently available for boned-out beef (over 10,000 carcasses per year) in the Anchorage-Fairbanks area.[28] Although no production feasibility analysis has been completed, such a study seems warranted. A corollary analysis would be necessary to consider the regional infrastructural components required in this type of red meat production.

In a 1968 study,[29] updated in 1971,[30] Burton examined the developmental problems associated with Alaska agriculture and surveyed state markets and types of crop and livestock enterprises. He viewed quite optimistically future marketing possibilities for pork, beef, reindeer, and milk production. However, he saw the expansion potential of potato, vegetable, and fruit production as more limited. Budgets using 1965-67 data indicated that revenue from hogs, dairy products, and potatoes could cover all explicit and implicit costs of production. Production costs were based on techniques and farm sizes prevalent at that time. Of

[24] U.S. Department of the Interior, Alaska Power Commission, *Development of New Lands in Matanuska-Susitna Borough* (February 1970).

[25] *Ibid.*

[26] *Alaska Agricultural Statistics*, various issues.

[27] U.S. Department of the Interior, Bureau of Reclamation, Alaska District Office, *Livestock Industry in Alaska* (January 1967). That portion of the U.S. Bureau of Reclamation that previously operated in Alaska is now called "The Alaska Power Commission."

[28] Stephens, et al., *Supplying Alaska's Red Meat and Poultry Markets*, p. 23.

[29] Wayne Burton, *Alaska's Agricultural Production Potential* (Ph.D Dissertation, Montana State University, 1968).

[30] Wayne Burton, *Alaska's Agriculture, An Analysis of Development Problems*, Institute of Social, Economic and Government Research Report No. 30 (Fairbanks: University of Alaska, October 1971).

the budgets given, only that for beef production could not generate sufficient revenue to cover all costs. This, however, was not surprising since Burton used the budgets from the Bureau of Reclamation's Kenai Peninsula livestock study.

Burton (1971) identified a large farming venture in the Delta-Clearwater area as an example of large-scale agricultural development. The goal of this farming operation, as defined in 1970-71, was to develop an annual production of 6,000 acres of barley and 14,000 hogs. Actual development to date has been somewhat different than planned. Although information is difficult to obtain, this same Delta farm as of 1976 has developed approximately 4,000 acres and, depending on market conditions, raises barley, straw or hay. There is presently no hog production enterprise, due in part to insufficient market facilities. A primary bottleneck was lack of hog slaughter facilities near the farm. All things considered, however, this large-scale farming operation must be considered a success to the extent that the owners continue to operate the farm, borrow funds, employ people, and produce large quantities of crops.

A 1969 study by Olson reviewed and assessed the Alaska reindeer industry.[31] The report states that Alaska Native owners of reindeer have only sporadically tapped markets beyond the traditional areas of production and consumption. In fact, because production is so tied to Native custom, Olson concludes that only non-Native management will bring about greater efficiency and increased production. He views this possibility with some dismay, because it may alter village life style. The advent of the Native corporations formed under the Alaska Native Land Claims Act may provide the stimulus for greater reindeer management efficiency by Native groups. From a marketing standpoint, significant markets, both locally and for export, exist with quite minimal input requirements (capital investments, labor, etc.) and production costs.

In 1972, the Tanana Valley irrigation study team completed the first in-depth agricultural study of a region other than the Matanuska-Susitna Valley.[32] The study, which was sponsored by the Alaska Power Commission, included information on soils, climate, water, crop yields, and irrigation, as well as economic analyses of crop and livestock enterprises. The study team identified 272,000 acres as potential farm land in the Delta-Clearwater, Wainwright-Eielson, and Totchaket regions of the Tanana Valley. It identified five types of potentially profitable farming operations: grain-hay, dairy, grain-hog, potato, and vegetable. The team then worked out projected budgets for grain-hay, grade-A dairy, and grain-hog farms at two levels of operation: 240 acres and 720 acres. It also worked out projected budgets for potato and vegetable farms of 40 and 120 acres. The study showed that a profit could result from all projected enterprises, with and without irrigation.

Yields, output prices, and input costs of this budget analysis were of 1970-71 vintage. Documentation in the report suggests that reasonable estimates were used. For example, higher labor costs were included because of the general difficulties in obtaining and retaining qualified labor in Alaska.

However, as with all previous studies mentioned, there are also problems with the Tanana Valley Irrigation Study. It emphasizes analysis of individual crop and livestock enterprises, but does not consider the aggregate situation. For example, the study does not consider the possibility of production increasing by 50,000 to 100,000 acres in Delta-Clearwater, and the resulting impact of increased competition among farmers both the input and output markets. How would attempts by more farmers to purchase these inputs or services affect price and availability of fertilizer, labor, land, or loanable funds? As a greater supply of feed grains or red meat enter the local market, how quickly would price deteriorate? What are the sensitive economic variables involved in producing food products in Alaska for export markets? The answers to these questions will identify the major problems which may retard the development of a greater market share from local farm sources. The implication is a severe one. Farm sector feasibility is limited by the markets and market infrastructure and vice versa. As of yet, no one has developed a regional economic analysis that predicts the interplay between these factors to determine how each influences the other.

The studies mentioned have all contributed to economic knowledge about agriculture in Alaska. However, none of them has addressed the significant issue of regional economic feasibility in considering both farm and market questions. A review of two feasibility studies[33,34] shows the problem of limited

[31] Olson, *Alaska Reindeer Herdsman.*

[32] Tanana Valley Irrigation Study Team, *Irrigation Potentials—Tanana River Valley Alaska,* Supporting Report, (February 1972).

[33] Norman Whittlesey and Walter Butcher, *Irrigation Development Potential in Washington,* College of Agriculture Research Center Circular 579 (Pullman: Washington State University, February 1975).

[34] Washington State University, *Horse Heaven Hills Irrigation and Development Potential,* College of Agriculture Study Team Report (Pullman: 1970).

infrastructure and market potential for new agricultural development to be less pronounced in the lower states. Generally, in every other state in the United States, significant variety and quantities of farm inputs, such as fertilizers and herbicides, are available locally, as well as some type of large-scale agricultural processing facilities. In addition, all the other states have sizeable markets for their agricultural products. None of the above is true for Alaska. This means that projected budgets measuring farm feasibility may not be meaningful if local inputs, including labor, are not available, and if there are no transportation, processing facilities, or clearinghouse functions for marketing within the state (or within 1,000 miles) for the particular product involved. And finally, feasibility studies in other regions of the United States do not have to deal with a banking system that knows little about local agricultural production except that, based on past history, it is a highly speculative venture.

In concluding this section, it seems obvious that too little is known about the interplay between enterprise production and markets to determine if, and under what conditions, large-scale agriculture in Alaska would be feasible. Just because an Alaska crop has a high production potential in a biological sense does not mean that its production is economically feasible. Nothing has been estimated regarding the impact of large-scale agriculture on employment, population, and income in a regional sense. However, in many respects a good start has been made toward understanding farm feasibility.

MARKETS AND THEIR INFRASTRUCTURE

For the following market analyses, the author makes two assumptions: (1) no long-term market gluts will occur in red meat or feed grain world markets, and (2) land in large units will be available for agricultural production in Alaska.

State Markets

There is little to be gained by developing estimates of statewide food markets in 1976 when there are few local agricultural products to be supplied to those markets. Even if development of large-scale agriculture in Alaska were to begin now, it would take ten years to obtain significant increases in production. Because knowledge of large-scale farming in northern latitudes is incomplete and because the private sector and the government lack adequate knowledge to deal with the problems, an estimate of twenty-five years seems more appropriate for obtaining significant increases in agricultural production.

Projecting statewide market size for the year 2000 (twenty-five years hence) requires estimating both state population and per capita consumption of agricultural products. Present consumption rates should provide some insight into the future. State per capita consumption or use-rate estimates are available for a few food products, such as red meat,[35,36] but these figures are either limited to regions, or they include tourists and short-term workers. Another source of information is the U.S. Army Corps of Engineers port-to-port data,[37] which includes food shipped to Alaska but does not divide it into discernible categories. We will therefore assume that Alaska consumers have consumption patterns similar to those in the rest of the United States. As Alaska becomes more urbanized and is increasingly populated by immigrants from the other states, its consumption should increasingly approximate national patterns.

Table 15 presents Alaskan consumption and production estimates for crop and livestock products in the year 2000 at a projected population of 820,000. It would be unrealistic to assume that in twenty-five years Alaska will be producing enough food to meet local needs. Agriculture in the other states is tied to a large, sophisticated agri-business complex which processes, packages, and transports more agricultural products than anywhere else in the world. Alaska agriculture cannot compete in providing a wide range of fully-processed food products to Alaska consumers at competitive prices. In addition, even where Alaska products can compete, consumers in Alaska have acquired store and brand preferences that might well preclude them from purchasing home-grown products. All of these factors suggest that state production required to supply local markets will be significantly less than potential consumption. Table 15 shows that in the year 2000, only reindeer production will be greater than 50 percent of the projected state consumption.

To supply statewide markets would require more land than is currently in production. According to

[35] Wayne Thomas, Charles Marsh, and Christopher Stephens, *An Economic Analysis of Red Meat, Fish, Poultry, and Wild Game in Anchorage*, Institute of Agricultural Sciences Research Report 73-4 (Fairbanks: University of Alaska, March 1973), p. 4.

[36] Stephens, et al., *Supplying Alaska's Red Meat and Poultry Markets*, p. 9.

[37] U.S. Army, Corps of Engineers, *Waterborne Commerce*, 1974.

TABLE 15

Estimated Alaska Consumption and Production For Agricultural Commodities in the Year 2000

Product	Alaska[a] Consumption	Alaska[b] Production
Beef (Mil Lbs. Dressed Weight)	95.5	11.5
Pork (Mil Lbs. Dressed Weight)	51.7	20.7
Lamb and Mutton (Mil Lbs. Dressed Weight)	0.8	.0
Reindeer (Mil Lbs. Dressed Weight)	0.8	2.6
Milk (Mil Lbs.)	200.0	100.0
Eggs (Mil Doz.)	13.4	6.7
Vegetables and Potatoes (Thousand Tons)	79.3	36.2
Fruit and Berries (Thousand Tons)	1.4	.7

[a]SOURCE Wayne Burton, *Defining Parameters of Agricultural Development Potential in Alaska*, Institute of Agricultural Science Bulletin No. 44 (Fairbanks: University of Alaska, 1975).

[b]SOURCE: Author's estimates.

this scenario, new land development will occur in the Tanana Valley and on the Kenai Peninsula (Table 16). The Matanuska-Susitna Valley (Southcentral) will produce high-value field crops (potatoes and vegetables) and will continue to produce milk only in large, concentrated farming operations. A net reduction of approximately 3,000 acres of cultivated land (primarily forage and grain crops) will occur in this region. Acreage in potato and vegetable production, both here and in the Tanana Valley, should increase but be constrained by limited processing facilities. Agriculture in the Tanana Valley should develop in both the Delta-Clearwater area and in the Totchaket area near Nenana in the form of small grains (barley and oats), pork, egg, and milk production.

This scenario also has agricultural acreage increasing on the Kenai Peninsula in the form of greater production of feed and forage for cattle. Greater range use will occur on Kodiak Island for cattle and on coastal grazing areas for reindeer. Cattle will be sold to provide lean carcasses for a state "manufactured-beef" market.[38] Reindeer production will supply local markets north of the Yukon River and be available at a retail level in more southern Alaskan communities.

Food prices will determine whether or nor this projection of agricultural development will occur in the next twenty-five years. Should prices continue to

TABLE 16

Acreage Necessary for Estimated Alaska Agricultural Production for the Year 2000

Commodity	South-Central	Tanana	Kenai	Kodiak	Reindeer Range
Beef					
Barley			5,000[b]		
Hay/Silage			14,900[b]		
Pasture			8,300		
Range				921,000	
Other			17,700		
Pork					
Barley		13,500			
Other		8,400			
Reindeer					
Range					20,000,000
Milk					
Barley	1,400[a]	8,000			
Oats	1,000[a]	3,300			
Hay/Silage	3,600[a]	10,000			
Other	3,800	13,300			
Eggs					
Barley		2,900			
Other		1,800			
Vegetable-Fruit					
Crop	1,950	650			
Other	1,300	450			
Total Acreage	13,050	62,300	45,900	921,000	20,000,000

[a] A total of 5,700 acres of barley, 2,200 acres of oats and 6,600 acres of hay/silage will be produced in Tanana Valley for Southcentral dairies.

[b] A total of 3,400 acres of barley and 10,100 acres of hay/silage will be produced on the Kenai and shipped to Kodiak.

SOURCE: Adapted from Table 2 and W. Burton, *Defining Parameters of Agricultural Potential in Alaska*, Institute of Agricultural Sciences Bulletin No. 44 (Fairbanks: University of Alaska, 1975).

[38] Stephens, et al., *Supplying Alaska's Red Meat and Poultry Markets*, p. 22.

rise in the developed world (primarily the United States) near the rates of the past three years, agricultural development of new lands will become more feasible. Production costs must be considered, but these are heavily influenced by government policy. For example, interest on borrowed operating and investment capital can be fixed by law. State governments (Alaska included) can provide state-backed loans at low interest rates. Increased fertilizer production can be, in part, brought about by favorable federal and state decisions regarding location and development of natural gas fields and pipelines. Government-owned land in large acreages can be cleared and made available to private farmers at low cost. Price of fuel can be reduced by government edict and taxation policies. Government can support development of such infrastructural components as grain elevators and agricultural processing sites, and can improve transportation access either by low-cost loans or by direct purchase and development.

These governmental activities are possible in Alaska. The state agricultural revolving loan fund presently exists and provides low-cost loans to farms. Alaska statute AS 38.07.010, enacted in 1967, provides a state subsidy for land clearing. Increased development is occurring near the gas fields in the Cook Inlet area, and fertilizer production capacity is being increased. In addition, the development of the North Slope natural gas field and the resulting gas pipeline, should it be routed through Alaska, may allow fertilizer production in the Interior.

If agriculture develops as suggested in Table 16, it would create a significant input market for this sector of Alaska's economy. The size of this particular market depends on the quantity of crops and livestock produced. Because the base of any production is land, approximately 74,500 acres of cultivated land will be required to meet the projected market in the year 2000. To this must be added 63 percent more land to be used for farmsteads, roads, and agricultural processing areas, bringing the total required land to 121,000 acres, excluding reindeer and cattle range (Table 16). The land market would quickly develop if large tracts were sold to private individuals. The complexities of leasing versus selling state land, with or without covenants, is beyond the scope of this paper, but must be considered before such decisions are made.

In addition to the required land base, certain quantities of production inputs are necessary for operation of agricultural enterprises. An estimate by commodity of labor, diesel, gasoline, liquid petroleum (L-P) gas, and electricity consumption is given in Table 17 by region. Fertilizer estimates by crop are given in Table 18.

How do these estimates compare with present Alaska agricultural requirements? In 1974, an average of 750 people were employed (full and part time) in Alaska agriculture.[39] The figure 1,054 given in Table 17 represents full-time jobs stated on an annual basis (for the year 2000). Since many of these can actually be accomplished by high school and college students and military people working part time, then the number employed, at least part time, will be greater than the 1,000 figure. No present cost estimates are available for farm diesel, gasoline, L-P gas, and electricity consumption; however, future use (year 2000) would be significantly greater than present use.

Fertilizer use in 1974 for Alaska approximated 3,517 tons.[40] By the year 2000, according to this scenario, the state total should be 16,460 tons—a 368-percent increase. Nitrogen-based fertilizer in 1974 accounted for approximately 52 percent of the total or about 1,828 tons. If one uses the same percentage for the year 2000, the present Kenai nitrogen fertilizer plant (Collier Carbon, Inc.) is already producing far more than the projected state requirements for the year 2000. Presently, and probably for the next twenty-five years, the non-nitrogen components of fertilizer will come into Alaska from external sources.

To farm 74,000 acres would require a capital investment in farm buildings and equipment significantly greater than presently exists in Alaska. Although precise data are not available, new investment costs of animal facilities, shop, shop equipment, farm equipment and farm storage would probably range between 50 million and 60 million dollars (1976 prices).

There is another aspect of statewide farm supply and service markets yet to be considered. Farm production requires numerous off-farm services. These include banks; equipment, feed, and fertilizer dealers; agricultural processing centers (grain elevators, animal and vegetable processing plants, etc.); and such general community businesses as construction firms and clothing stores. The amount of such related nonfarm economic activity will be determined by the amount of new land brought into production and the crop mix. Approximately 17,000 acres of cultivated agricultural land is presently in

[39] Alaska Crop and Livestock Reporting Service, *Alaska Agricultural Statistics*, various issues.

[40] Alaska Crop and Livestock Reporting Service, *Alaska Farm Reporter*, November 1974.

TABLE 17

Labor, Diesel, Gasoline, Liquid Petroleum Gas, and Electricity Requirement for Estimated Alaska Agricultural Production in the Year 2000

	Labor (Person-Years)	Diesel (Thousand Gallons)	Gas (Thousand Gallons)	L-P Gas (Thousand Gallons)	Electricity (MKH)
Southcentral					
Milk	242	66	99	33	.94
Vegetables & Fruit	41	17	26	9	.07
Tanana					
Pork	167	119	179	60	.65
Milk	98	60	91	30	.32
Vegetables & Fruit	14	6	9	3	.03
Eggs	161	26	38	13	.10
Grain[a]	28	63	94	31	.04
Hay/Silage[a]	24	53	80	27	.03
Kenai Peninsula					
Beef	112	341	513	184	.86
Kodiak					
Beef	54	b	b	b	b
Reindeer					
Range	60	b	b	b	b
Total	1,054	751	1,129	390	3.04

[a] For transhipment out of region to Southcentral for milk production.

[b] Not estimated.

SOURCE: Adapted from Table 3 and W. Burton, *Defining Parameters of Agricultural Potential in Alaska*, Bulletin 44, (Fairbanks: Institute of Agricultural Sciences, University of Alaska, August, 1975.)

TABLE 18

Alaskan Fertilizer Use by Type of Crop for Estimated Alaskan Agricultural Production in Year 2000 (Tons x 1,000)

	Barley and Oats for Grain	Hay/Silage	Pasture	Vegetables and Fruit
Southcentral	.24	.94	-0-[a]	1.65
Tanana	1.42	2.00	-0-[a]	.55
Kenai Peninsula	.85	5.66	3.15	-0-
Total	2.51	8.60	3.15	2.20

[a] Pasture use was quite small.

SOURCE: Adapted from Table 3 using coefficients derived from W. Burton, *Defining Parameters of Agricultural Development Potential in Alaska*, Bulletin 44, (Fairbanks: Institute of Agricultural Sciences, University of Alaska, August, 1975).

production.[41] According to the scenario presented here, by the year 2000 there will be an additional 57,500 new acres. To assess the business development that may occur in conjunction with this new acreage, I used as a model a dry land farming area in central Washington.[42] However, the crop mixes in the Tanana and Matanuska valleys and on the Kenai Peninsula are more complex than the dry land example used. Therefore, the following projections are probably underestimated.

A total of twenty businesses, sixteen caused by

[41] *Alaska Agricultural Statistics*, various issues.

[42] A.L. Walker, et al., *The Economic Significance of Columbia Basin Project Development*, Agricultural Experiment Station Bulletin 669 (Pullman: Washington State University, September 1966).

new land development,[43] would be associated with agricultural development (Table 19). These businesses would employ 142 people with total off-farm population comprising 554 people. The distribution of businesses and people would be in some relation to the amount of acreage in each region. In the Tanana Valley, the businesses might well be located in or near the major urban center, Fairbanks, instead of in Delta Junction or Nenana.

In conclusion, it would be appropriate to review the projections of crop land and agricultural enterprises that provide the basis for a projected 57,500-acre increase in agriculture to serve state markets. Agriculture in the Matanuska-Susitna Valley (Southcentral region) is expected to decline in acreage from the present level, but to increase in quantity of milk, vegetables, and potatoes produced. Much of the feed for milk production would be grown in the Tanana Valley and shipped and stored in the Matanuska Valley. Agriculture in the Tanana Valley would expand more rapidly in the Delta-Clearwater area, but the Nenana region would have the greatest percentage increase since it is starting at a zero production level. Pork and egg production would center in the Tanana Valley. However, agriculture will not be limited to supplying local markets. As noted in the next section, significant growth in Alaska agriculture will probably come from sales to export markets. In fact, development of agriculture for in-state markets will probably follow development of agriculture for export markets.

[43] The remaining four businesses are associated with agricultural land in production in 1976.

TABLE 19

Total Employment, Number of Businesses and Population Generated by Agricultural Development in Alaska for the year 2000

Type	Per 10,000 Acres	Per 74,500 Acres
Secondary Employment		
Processing and Marketing (No. of Workers)	1.1	8
Tertiary Employment		
General Business (No. of Workers	13	97
Government (No. of Workers)	5	37
Total	19.1	142
Number of Businesses		
Contract Construction	.3	2
Manufacturing	.2	1
Transp., Communication, & Public Utilities	.1	1
Wholesale and Retail Trade	1.5	11
Finance and Real Estate	.2	1
Services	.5	4
Total	2.8	20
Population		
Off Farm	74	554

SOURCE: A. Walter, et al., *The Economic Significance of the Columbia Basin Irrigation Project Development*, Washington Agricultural Experiment Station Bulletin No. 669 (Pullman: Washington State University, 1966), and author's estimates.

Export Markets

Alaska can grow a variety of cold weather crops. An obvious crop is barley, which is used as both a human and animal food in a number of countries of the world; a significant potential market for barley and other grains is Japan.

Tokyo, Japan is about as far from Anchorage as is New York. Japan is a country with a large population and limited land area. The amount of cultivated land in Japan has dropped from 8,129,000 hectares (20,087,000 acres) in 1960 to 5,752,000 hectares (14,213,000 acres) in 1974.[44] During the period 1960-1973, grain, potato, and bean production declined in Japan (Table 20). On the other hand, production of livestock products, primarily pork and poultry, increased significantly during the same period (Table 21). Also, per capita consumption of pork and poultry products increased five-fold between 1960 and 1973 (Table 22).

Increased consumption of meat and poultry can be viewed as shifts to the right in the demand curve for those products (Figure 3). This increase in quantity consumed has occurred in large measure because (a) the taste and preference function of the Japanese population is shifting toward a more Western diet (higher in red meat and poultry protein), and (b) real income levels in Japan are rising. These factors tend to indicate a continued strong market in Japan for red meat and feed grains.

Since domestic supplies of feed grains have been declining in Japan, the resulting difference between what is produced and what is needed to supply feed

[44] "Food Problem and Japan's Agriculture, Forestry and Fisheries," *Look Japan*, 10 November 1975, p. 6.

TABLE 20

Japanese Output of Principal Farm Products, 1960-1973 (Tons x 1,000)

F.Y.	1960	1965	1970	1971	1972	1973
Grains	17,101	15,208	13,858	11,945	12,613	12,658
Rice	12,858	12,409	12,689	10,887	11,897	12,149
Wheat	1,531	1,287	474	440	284	202
Barley, Rye	2,301	1,234	573	502	324	216
Corn	113	75	33	25	23	17
Maize	2	1	--	--	--	--
Other Grains	296	202	89	90	85	17
Potatoes	9,871	9,011	6,175	5,312	5,598	5,030
Beans	919	646	505	417	510	451
Soybeans	418	230	126	122	127	118
Others	501	416	379	295	383	333
Vegetables	11,742	13,490	15,131	15,777	15,837	15,315
Fruits	3,307	4,025	5,454	5,351	6,420	6,501
Orange	1,034	1,331	2,552	2,489	3,568	3,389
Apple	907	1,132	1,021	1,007	959	963
Others	1,366	1,562	1,881	1,855	1,893	2,149
Crude Sugar	5	85	78	71	243	247

SOURCE: Japan Ministry of Agriculture and Forestry, "Food Consumption Statistics." This is Table 6 in *Look Japan*, Tokyo, Vol. 20, No. 235, November, 1975.

NOTE: Figures preceding fiscal 1971 do not include Okinawa Preference.

for the increasing livestock industry comes from import sources. The United States is a large supplier of feed grains, primarily corn and grain sorghum, to Japan. Other countries exporting feed grains to Japan include Australia, Thailand, Argentina, Canada and South Africa. In 1974, the United States supplied only 4 percent of the barley imported by Japan;[45] the total Japanese barley imports were 1,418,000 tons.[46] Barley imports are not presently controlled by the Japanese government and have a duty-free status.[47]

During the twenty-five-year period to 2000 A.D. Japanese consumption patterns will probably tend toward higher per capita consumption of red meat and poultry. Likewise, Japanese production of barley (for human and animal use) may increase, but not in proportion to feed requirements. Given these assumptions, Japan should be importing at least 2,000,000 tons of barley by the year 2000.[48]

There are three broad reasons why Alaska will probably not be able to capture a significant amount of this Japanese market:

1. To supply the entire Japanese import market for barley by 2000 A.D., would require that over 1,100,000 new acres of Alaska land be cleared, planted, and harvested, along with the corresponding development of a large agricultural infrastructure (this assumes a yield of seventy-five bushels per acre). The technical problems associated with such a large project over a twenty-five year period make it unlikely to occur.
2. Significant price competition might develop if the other suppliers of Japanese barley come to fear the loss of a major market.[49] An intense

[45] Bruce Greenshields, "U.S. Farm Exports to Japan May Rebound in 1975-76," *Foreign Agriculture* 13 (October 1975):4.

[46] "Food Problem and Japan Agriculture...," *Look Japan*, p. 21.

[47] Greenshields, "U.S. Farm Exports to Japan...," p. 3.

[48] The Japanese government estimates that in 1985, domestic consumption will reach 2,500,000 tons and imports 1,600,000 tons. Japan Ministry of Agriculture and Forestry, *Long Term Prospect of Production and Demand for Agricultural Products in Japan* (August 1975), p. 3.

[49] This assumes the numbers of suppliers to be small, and each therefore would be able to assert some influence on price.

TABLE 21

Japanese Output of Livestock Products, 1960-1974

Actual Figures (1,000 Tons)

Products	1960	1965	1970	1971	1972	1972	1974
Dairying	1,887	3,221	4,761	4,820	4,939	4,908	4,864
Meats	392	793	1,410	1,575	1,694	1,776	1,990
Beef	142	208	261	275	295	227	293
Pork	147	364	648	750	769	858	964
Poultry	75	204	490	540	622	685	729
Eggs	–	1,063	1,734	1,801	1,794	1,800	1,803

SOURCE: Japan Ministry of Agriculture and Forestry, *Milk and Dairy Products Statistics* and *Egg Distribution Statistics*, Ministry of Health and Welfare, *Sanitation Administration Duties Report*. Figures on Poultry obtained from Livestock Bureau, Ministry of Agriculture and Forestry. This is Table 8 in *Look Japan*, Tokyo, Vol. 20, No. 235, November, 1975, p. 6.

TABLE 22

Japanese Annual Per Capita Consumption of Principal Foodstuffs, 1960-1973

(In Kilograms)

F.Y.	1960	1965	1970	1971	1972	1973
Grains	149.6	145.0	128.5	127.0	125.0	124.6
Rice	114.9	111.7	95.1	93.2	91.7	91.1
Wheat	25.8	29.0	30.8	31.0	30.9	31.0
Barley, Rye, etc.	8.9	4.3	2.6	2.8	2.4	2.5
Potatoes	30.5	21.4	16.2	16.5	16.6	16.2
Starch	5.5	8.3	8.1	7.8	8.0	7.9
Beans	10.2	9.4	9.8	10.0	9.8	9.8
Vegetables	99.7	109.6	115.6	119.5	117.8	112.4
Fruits	22.3	28.5	38.2	38.1	44.2	43.7
Meat (excluding Whale Meat)	3.4	6.7	11.5	13.3	14.2	16.2
Beef	1.1	1.4	2.0	2.3	2.4	2.3
Pork	1.1	2.7	4.7	5.1	5.6	6.4
Poultry	0.8	1.9	3.7	4.3	4.7	5.1
Others (Mutton, etc.)	0.4	0.7	1.1	1.6	1.5	1.4
Chicken eggs	6.3	11.6	14.8	14.9	14.6	14.5
Milk, Dairy Products	22.3	37.4	50.1	50.7	51.8	52.9
Sugary Foods	4.3	6.6	9.5	9.9	10.6	11.1
Marine Foods	27.8	29.2	31.8	33.3	33.3	34.3

SOURCE: Japan Ministry of Agriculture and Forestry, "Food Consumption Statistics." This is Table 2 in *Look Japan*, Tokyo, Vol. 20, No. 235, November, 1975.

NOTE: (1) Figures above relate to unadulterated foodstuffs. (2) Figures for fiscal 1972 include Okinawa Preference.

price competition and resultant market uncertainty would have greater impact on new land development in Alaska than on an existing land settlement in other regions of the world.

3. Japan would likely find it undesirable to break old trade arrangements and buy a majority of its barley from Alaska, given the spotty history of agriculture in the state and its limited experience (even twenty-five years hence) with large-scale barley production.

Considering these reasons, I assume that only a small portion of the Japanese market, less than 10 percent (or about 100,000 acres), will be easily accessible to Alaska grain producers by the year 2000. The Tanana Valley area near Delta Junction contains over 200,000 acres of land which could be used to grow barley. Large scale development for barley there would require at least one grain elevator for necessary drying and storage before shipment to a tidewater port (probably Anchorage). Rail transportation would probably be the cheapest way of moving the grain to port. If a rail spur were constructed to Delta Junction, the elevator and the acreage would probably develop in that area.

A 1972 study analyzed the feasibility of growing grain and hay in the Delta-Clearwater area on several farms varying in size up to 720 acres.[50] Total farm

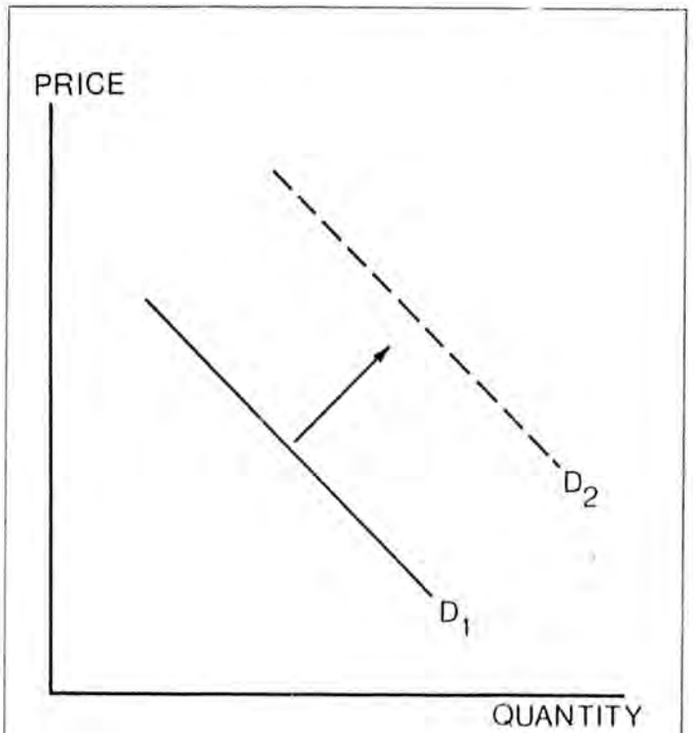


Figure 3: A Representation of the Japanese Demand Curve For Red Meat and Poultry, Where D_1 = 1960 and D_2 = 1974.

expenditures[51] (fixed plus variable costs) for a 720-acre grain/hay operation was estimated at $88.98 per acre assuming yields of 1.2 tons per acre. The variable expenses portion of this was broken out at $54.23 per acre for this same farm.[52] Revenue from sales to Japan would have generated $76.49 per acre F.O.B. Japan in 1972.[53]

The implication is that although revenue could

[50] *Tanana Valley Irrigation Study*, p. VI-20.

[51] Based on 1971 data.

[52] A transportation cost per ton from point of production to Japan is not included in these total or variable cost figures.

[53] *Look Japan*, p. 21. This assumes an average price of $63.74 per ton F.O.B. Japan.

have covered variable expenses in a synthesized Delta-Clearwater grain/hay farm for barley production, it could not cover fixed expenditures. Thus, while the farm could operate over the short run, it could not replace plant and equipment over the long run and would cease to operate. However, the revenue picture changed significantly in 1973 and 1974. On a per acre basis (assuming 1.2 tons of barley production per acre), revenue would have increased to $129.80 in 1973 and to $202.26 in 1974, using average price F.O.B. Japan for imported barley.[54] Revised cost estimates are not available; however, we can safely assume that farm costs also increased, but the rate was probably significantly less than the rise in revenue per acre.

If world feed grain supplies increase more rapidly than world demand, Alaska may not be able to compete in world markets. If the opposite occurs and the grain price increases of 1973 and 1974 are not a short-term aberration but indicate an upward price trend, Alaska will probably become competitive.

To be more specific, achievement of an export market by the year 2000 would require a significant use of agricultural inputs and development of an agricultural infrastructure (Table 23). Grain production for export alone would increase the on-farm labor force by an estimated 150 full-time jobs[55] and fertilizer useage by 10,000 tons.[56] Estimated increases in diesel useage (over that shown in Table 17) would be 106 percent; gasoline, 106 percent; L-P gas, 90 percent; and electricity, 16 percent above requirements for state markets.[57]

Using a major small-grain, dry-land production area in Washington[58] as a model for Tanana Valley development, 100,000[59] acres of new agricultural land would create 191 nonfarm jobs (agricultural processing, general business, and government). A total of twenty-eight businesses would be needed to support this farm production. The production of 174,500 acres of cropland in all three farming regions of the state would generate employment throughout the entire agricultural sector, including state and export markets. Total population of the state, attributable to agriculture and related off-farm employment, would total 6,000, with 1,300 of these associated with the export market.

TABLE 23

Estimated Employment and Number of Businesses Required to Serve Both Export and State Agricultural Markets for the Year 2000

	Export	State	Total
Employees			
Agricultural Market and Processing	11	8	19
General Business Firms	130	97	227
Government	50	37	87
Total	191	142	333
Number of Businesses			
Contract Construction	3	2	5
Manufacturing	2	1	3
Transportation, Communication & Public Utilities	1	1	2
Wholesale and Retail Trade	15	11	26
Finance and Real Estate	2	1	3
Services	5	4	9
Total	28	20	48
Population			
On-Farm	585	4,111	4,696
Off-Farm	745	554	1,299
Total	1,330	4,665	5,995

SOURCE: A. Walter, et al., *The Economic Significance of the Columbia Basin Project Development*, Washington Agricultural Experiment Station Bulletin 689 (Pullman: Washington State University, Sept., 1966), and author's estimates.

The required farm capital investment in buildings and equipment to provide for the export market would be extensive. If the 100,000 acres comprised 50 individual farming operations, they would require approximately 100 tractors, 50 combines, several hundred farm implements, trucks, and small buildings. New investment costs for farm equipment, shop, shop equipment and farm storage for 50 farmsteads would total approximately 8 to 10 million dollars (1976 prices). A grain elevator would also be necessary, with an investment cost of around three million dollars (1976 prices), to provide sufficient

[54] *Look Japan*, p. 21.

[55] Calculated for 100,000 acres of production using coefficients from U.S. Department of Agriculture, *Agricultural Statistics* (1973), p. 449.

[56] Calculated for 100,000 acres of production using coefficients from W. Burton, *Defining Parameters of Agricultural Production in Alaska*, pp. 13 and 28.

[57] *Ibid.*, pp. 14-17, 28.

[58] Walker, et al., *...Columbia Basin Project...*, AES Bulletin 69.

[59] Depending on method of farming used, as much as 200,000 acres of land might have to be cleared to obtain a yearly average of 100,000 acres in production.

drying and storage capacity for both export and state markets.

The export market would also require development of specialized rail transportation to Anchorage and a grain-loading facility there. Since 100,000 acres could produce only 180,000 tons of export, an extensive port-loading facility would not be necessary. According to 1975 prices, an investment of approximately $2.5 million would be required. The tonnage of grain would require eighteen ships of 10,000 dead-weight ton capacity (Liberty or Victory steamship types) to transport the grain to Japan. This type of ship is presently being operated by firms involved with the international grain trade.[60] This means that once Alaska grain reached a tidewater port such as Anchorage, the existing distribution system could handle transportation to Japan.

Japan should not be the only country considered for grain exports from Alaska. Numerous countries in Western Europe, as well as the Soviet Union, also import feed grain. The west coast area of the U.S. is also deficient in feed grain. I have emphasized the Japanese market for feed grains here because it is reasonably close; Alaska and Japan have had long-established trade ties, and Japan is looking for politically stable supply areas to provide food products for its home market.

From an Alaska viewpoint, the creation of an export feed grain base would stimulate development of a red-meat industry within the state. Large quantities of locally produced grain would reduce the difficulties of obtaining feed for animal rations. This would provide for the development of both small and large scale pork and beef enterprises. The state then would be able to supply a greater portion of Alaska's pork and beef consumption needs (Table 15) and possibly produce pork and beef for an export market.

SOME FINAL THOUGHTS

I have indicated no agricultural development for the Yukon Basin, Alaska Peninsula, Copper River Valley and Kuskokwim Basin. Development beyond small farms supplying local markets is possible in the next twenty-five years, but not expected. Little is known of the agricultural potential of these areas; many are remote from surface transportation systems; and land ownership at this time is unsettled. Having the potential for and achieving a large-scale agriculture are two different things. In the next twenty-five years and beyond, only the possibility of a high return on investment, which would depend on food prices continuing to increase, will cause development in these areas.

What about the regions identified in this report—Kenai Peninsula, Kodiak, and the Tanana Valley? The amount of beef produced in Kenai and Kodiak should increase, because the state, through its Division of Agriculture and University of Alaska, is working on an expanded red meats and forage research and development program which should pay off by the next century. The industry will, for the first time, be receiving technical production support and, at the same time, facing an expanding manufactured (lean carcass) beef market.

The Tanana Valley has the most possibilities for agricultural development because of a large land base, a developed transportation system, and an embryonic agriculture. Land-use planning projects are underway in both Delta-Clearwater and Nenana, which when complete, will describe and promote use of new lands for agriculture. If the economic incentive is present, and positive state and federal land policies are put into effect, these lands will be developed.

The export market for grain is the base for large-scale development of agriculture. There are risks involved here, however. During soft market conditions, local producers in Alaska and elsewhere might be faced with world grain prices that are lower than cost of production. If a significant agriculture is to be developed in Alaska, the state may have to develop a support and subsidy program (in conjunction with Federal programs) to protect against weak market years. Agriculture in Alaska may not be able to sustain itself in the early period of major development (the next twenty-five years) without such state support. This type of policy decision must be much more fully explored before an intelligent decision can be made for or against state involvement.

Finally, other commodities besides barley and pork could be produced in Alaska and exported. Reindeer could easily move into the exotic meat trade and be shipped in small amounts to many markets throughout the world. Milk could be produced in the state, dehydrated, and shipped to export markets such as Japan. Another possibility is foreign export of beef and pork. One problem associated with foreign exportation of milk and red meat is the strict sanitation regulations placed on these products by foreign governments. Another problem is that markets are never certain because many foreign governments place quotas on red meat

[60] Letter from Kenneth Casavant, Associate Professor of Agricultural Economics, Washington State University, 1976.

and milk, and these vary by year. A major advantage of feed grains is that in countries like Japan, a quota system is currently not used, and the commodity has low perishability; therefore, minimum sanitation regulations are issued by the importing nation.

In conclusion, it should be observed that the estimated projections presented here are meaningless unless (1) a land base is made available to agriculture and (2) world market forces provide an economic incentive for agricultural production in Alaska.

Wayne Thomas is an associate professor of economics with the Agricultural Experiment Station, University of Alaska, Fairbanks.

APPENDIX

PERCEPTIONS OF REALITY—ALASKA'S AGRICULTURE AND FOOD DISTRIBUTION SYSTEM*

In this section we set forth a number of our perceptions concerning Alaska's agriculture and its food distribution system. Readers of this report may disagree with a number of our perceptions, and in fact, some disagreement is expected. However, this disagreement can be helpful in focusing on those areas of inquiry where additional information is needed.

Our perceptions take either the form of statements of fact or issues that need an answer. They are presented in six major categories, with sufficient detail to attempt a clear, but concise, presentation.

Land

1. Land serves as a base for renewable and nonrenewable resource industries.

2. There will be competition between various renewable industries for the use of the land.

3. Land can be classified on a single-use basis or a multiple-use basis. A major question is which lands for which purposes?

4. Alaska currently has a scarcity of private land. Other than the Native lands, the amount of privately owned land comprises an area smaller than the District of Columbia. Agricultural development has been seriously hindered by this scarcity of land. Not only has there been little opportunity for agricultural expansion into large commercial farms, but land has been bid away from agricultural uses in favor of subdivision settlement or homesites.

5. There appears to be a relatively strong demand by individuals for homesites and recreational sites of 5 to 160 acres. This demand could most likely be satisfied from land other than large blocks of potential agricultural land. Land that has good potential for commercial agriculture could be primarily reserved for agricultural use.

6. Large quantities of land suitable for cereal grain and forage production are located in the Interior along major rivers. The exact acreage is somewhat indeterminant, but it amounts to millions of acres. (The Soil Conservation Service estimate is 17 million acres of agricultural land in Alaska.)

7. Native corporations control sizeable quantities of potential agricultural land. At some point in time, these corporations may choose to develop these lands for agricultural production or enter into an arrangement to have the lands developed. The decision processes would be more internalized than that of the state.

The Development Process

1. Agriculture was the basic industry in the early development of the lower 48 states. Industrialization came later as agriculture moved through the nation, especially the West. In Alaska, agriculture never developed into a sufficiently large or pervasive enough industry to be called basic. Because Alaska can now be considered somewhat industrialized, agriculture would have to be added to the industrial base rather than vice versa. One would not expect agricultural development in Alaska to follow the general pattern experienced by most of the lower 48 states.

2. There is no large, strong political and economic power base for agriculture. There appears to be little opposition to agriculture *per se*. Thus there appears to be a more or less indifferent attitude toward agriculture. Opposition would be expected to occur when and if conflicts between the uses of land arise and agriculture is a contender.

3. The perceptions that most individuals have concerning the potential of agricultural development in Alaska is negative. This perception would need to be changed if agriculture is to succeed in Alaska.

4. Agricultural development policy is interrelated with general economic development, e.g., growth policy, settlement policy, land and other resource policy.

5. The 40- to 160-acre homestead type of farming operation has not led to significant agricultural development. It is not likely to lead to significant development in the future. There may be some exceptions for very intensive crop production.

6. Alaska contains large land areas, so the creation of large commercial farms is possible at the start of the development process. The situation is more comparable to the development of large farms on the west side of California's San Joaquin Valley than the smaller farm units in the Columbia Basin Project of Washington State.

7. If expansion of agricultural output in Alaska takes place, it will not come from the expansion of the current system. Not only would the type of farming likely be different, but the farm operators would be expected to primarily come from the lower 48 states or from nonfarm employment in Alaska.

8. Agricultural development occurs in a process of stages or steps. A strong and dependable grain and forage economy is the first step to a strong livestock economy. Thus, one would expect the grain and forage to be produced internally or be imported. For Alaska the latter does not appear to be economically feasible on a large scale. Vegetable production

*From a report prepared by J. Edwin Faris and R. J. Hildreth for the Joint Federal-State Land-Use Planning Commission for Alaska in cooperation with the Agricultural Experiment Station, School of Agriculture and Land Resources Management, University of Alaska.

on a large scale requires a rather sophisticated infrastructure. Such an infrastructure is most difficult to create from scratch.

9. Many people see a dilemma in agricultural development: Which comes first, the land reservation or the proof of success? Agricultural lands need to be available before agricultural development can take place. But it may be necessary to demonstrate that agricultural production is economically viable before lands could or would be set aside for agriculture.

Agricultural Output

1. Alaska, as compared to the lower 48 states, has unique climate conditions. This uniqueness makes it extremely unlikely that agricultural production practices would be directly transferable from the lower 48. At the minimum, adaptive research would be needed to make production technology applicable to Alaska's conditions. Systems of producing, storing, and marketing agricultural commodities would apt to differ from those in the lower 48 states. This is consistent with differences among these states; e.g., irrigation in the West and lower grain yields in the Southeast than in the Midwest.

2. The current and future state, national, and international needs for agricultural output will greatly influence the need for agricultural development.

3. The development of an agricultural industry in Alaska could lead to increases in gross state product and gross national product over time.

4. Limited data prevent performing a rigorous estimate of costs and benefits of a potential agricultural industry. First, there is really very little comparable agriculture in Alaska at the current time. Second, public and private costs of the necessary infrastructure are not known. Third, the social costs and benefits need to be estimated.

5. There are a number of specialty crops, such as seed crops, where Alaska has a unique advantage over other production areas.

6. Very satisfactory yields of barley and oats have been attained on the type of agricultural soils found in interior Alaska. Yields of wheats tested recently are less certain. This land might need to be irrigated in some areas or summer fallowed in others to obtain satisfactory and dependable yields. It appears that the rivers could serve a most important role in the transportation network.

7. Heat losses from pipeline pumping stations or other industrial endeavors may in some cases be useful to agricultural production or processing. A controlled environment greenhouse production unit could probably be developed using the heat losses to produce such crops as vegetables, flowers, and house plants. The heat might also be used to help power a pelletization plant for agricultural forages.

8. The recreational horse population is a most serious competitor for the limited amount of hay and grain produced in Alaska. This drives up the cost of hay and grain which makes it less profitable to produce milk and red meat animals. With a strong grain economy in Alaska, this distortion would not occur.

9. Agricultural research, although limited, indicates that the production potential is great. One way to determine if it would also be economically profitable is to promote agricultural development in an area based on the large, efficient-size farm concept.

Agricultural Infrastructure

1. Significant development of the agricultural potential in Alaska would absolutely require major public and private investments in the infrastructure. Without attempting to determine which investments are public and which are private (or perhaps both), some major infrastructure investments would need to be made in (a) water-based transportation facilities; (b) roads; (c) education; (d) agricultural research and extension; (e) storage, drying, and processing facilities; and (f) input supply firms such as those supplying fertilizer and insecticides.

2. It is possible that Alaska's farmers could have a competitive advantage in obtaining certain fertilizers and other petrochemicals in the future relative to a number of farming areas in the lower 48 states. This is contingent upon more of the petroleum being processed in Alaska.

3. Transportation rates may tend to work adversely against agriculture. The rates have been based on low volumes or historical patterns. With larger volumes and competitive pressures, the rate structures should change and become more favorable toward agricultural production and marketing. This includes both rail and water freight rates.

4. The South and and Kenai Peninsula areas have a reasonably adequate transportation network to the Anchorage market. These lands have potential for vegetable production on a small scale until a better infrastructure is developed. Grazing of cattle also could increase, with increased slaughter capacity and marketing channels.

5. A large portion of Alaska's population is in, or adjacent to, urban centers. The well-developed food distribution system serves a large majority of the state's population. The food chain infrastructure is based on a food-import economy.

The Environment

1. The side effects of various types of agricultural enterprises and organizations upon the environment need to be given attention.

2. If agriculture were to develop on a very large scale, it would undoubtedly affect the Native culture and style of living in some areas. Some adjustments could be made to minimize these effects. Opposition to the development of agriculture in these areas may materialize.

3. There would be environmental effects resulting from agricultural production. The type and magnitude of these effects as now seen appear to be based more on value judgements than on analytical data. For example, a conflict may not exist between the use of land for agricultural purposes and for certain wildlife habitat. In fact, agricultural production could increase the number of some types of birds and decrease others or perhaps decrease the number of large fur-bearing animals.

This report was partially funded by the Joint Federal-State Land-Use Planning Commission for Alaska.

RECENT INSTITUTE PUBLICATIONS

The Institute of Social, Economic and Government Research was established in 1961 for the purpose of conducting interdisciplinary research in the social sciences and related fields. The institute is part of the University of Alaska and has branches in Anchorage, Fairbanks, and Juneau. In addition to the *Alaska Review of Business and Economic Conditions*, the institute publishes ISEGR *Reports*, *Occasional Papers*, *Research Notes*, and other special publications. Recent institute publications are listed below:

REVIEWS

(Free subscription upon request)

- "Oil and Gas Regulation in Alaska," Tim Bradner
- "Age and Race by Sex Characteristics of Alaska's Village Population," Ron Evans and Peggy Raybeck
- "Estimated Gross State Product for Alaska," David T. Kresge and Monica Thomas
- "Alaska Economic Growth, 1961-1972," David T. Kresge
- "Consumer Prices, Personal Income and Earnings in Alaska," Arlon R. Tussing and Monica Thomas
- "Estimates of Alaska Gross Product By Region, 1965-1973," Monica E. Thomas and Earlene Goodwin
- "Fiscal Data for Alaska," Neville O. Beharie
- **"Alaska's Growth to 1990," David T. Kresge**

OCCASIONAL PAPERS

- *Wildlife Management and Alaska Land Use Decisions*, Robert B. Weeden $1.00
- *Equalization of Local Government Revenues in Alaska*, Richard W. Garnett, III. $1.00
- *Northern Eskimo Law Ways and Their Relationships to Contemporary Problems of "Bush Justice,"* Arthur E. Hippler and Stephen Conn $1.00
- *Patterns of Village Growth and Decline in the Aleutians*, Dorothy M. Jones $1.00
- ***Urban Native Men and Women—Differences in Their Work Adaptations*, Dorothy M. Jones $2.00**

REPORTS

- *Alaska Public Policy*, edited by Gordon S. Harrison $5.00
- *Alaska Pipeline Report*, Arlon R. Tussing, George W. Rogers, and Victor Fischer ... $5.00
- *Alaska Fisheries Policy*, Arlon R. Tussing, Thomas A. Morehouse, and James D. Babb, Jr. $10.00
- *Effective Teachers of Indian and Eskimo High School Students*, Judith Kleinfeld $2.00
- *Land Claims and Native Manpower*, Judith Kleinfeld $2.00
- *An Electoral Profile of Alaska*, Thomas A. Morehouse and Gordon S. Harrison $3.00
- *A Long Way From Home—Effects of Public High School on Village Children Away From Home*, Judith Kleinfeld $5.00
- *Alaska Natives in Higher Education*, Karen Kohout and Judith Kleinfeld $3.00
- *The Subarctic Athabascans—A Selected Annotated Bibliography*, Arthur E. Hippler and John R. Wood $15.00
- **An Aleut Bibliography, Dorothy M. Jones and John R. Wood $15.00**
- *Bristol Bay—A Socioeconomic Study*, David T. Kresge, Susan R. Fison, and Anthony F. Gasparro $5.00
- *The Urban Native Encounters the Social Service System*, Dorothy M. Jones $3.00
- *Alaska's Constitutional Convention*, Victor Fischer $4.00

RESEARCH NOTES

(Free upon request)

- *The Population of Russian America (1799-1867)*, Svetlana G. Federova
- *Using Nonverbal Warmth to Increase Learning—a Cross Cultural Experiment*, Judith Kleinfeld
- *Alaskan Population Growth and Movements, 1960-1972*, Daniel A. Seiver and Susan R. Fison

UNIVERSITY OF ALASKA

MEMORANDUM

TO: Clark Gruening, Chairman, House Special Committee on the Alaska Permanent Fund

FROM: The Institute of Social and Economic Research

SUBJECT: Alternative Approaches to Calculating Contributions to the Permanent Fund

November 18, 1977

Introduction: As part of ISER's contract with the committee to analyze the economic impacts of alternative investments and policies of the Permanent Fund, ISER is also to address the issue of how the legislature might go about determining the level of contributions to be made to the Permanent Fund beyond those constitutionally mandated.

As previous analyses of investments and expenditures using ISER's economietric models have already suggested, the determination of an appropriate pattern of state expenditures involves considerations far broader in scope than simply the provision of public services to satisfy the demands of a stationary population. Because state government plays a central role in determining the overall level of economic activity in the state, via direct employment and expenditures in other sectors of the Alaska economy, savings/expenditure choices confronting the Alaska Legislature are most appropriately considered within the context of the impact of alternative choices on the growth of employment, population and incomes in the state and on the ability of the state to sustain such growth in the long run. These considerations are of particular importance given that much of any expenditure growth is to be financed from revenues derived from depletable resources.

Two alternative approaches might be suggested in approaching the savings/expenditure choice. At the one extreme, one might adopt simple savings formulas, or rules, to minimize policy discretion over expenditure choices. At the other extreme, one might adopt a fully discretionary expenditure policy in which decisions on savings and expenditures are based solely on considerations of current economic conditions. Neither extreme is likely to be wholly adequate in serving both the goal of satisfying local demands for services by the existing state population and the long run growth goals of the state.

In order to satisfy the demands of the local population for public services, some simple formula approach might be deemed appropriate. However, to take into account the growth effects of state policy, some more elaborate, and more flexible, formulations would be required. This memo is intended to present some preliminary, simple formula approaches, as well as the limitations of such approaches. It also discusses the types of considerations which are relevant to the development of appropriate expenditure rules and which adequately capture the growth effects of any state savings/expenditure choice.

The following memorandum identifies these important variables and discusses how they are related to one another. These relationships can become quite complex and, when expressed in mathematical terms, confusing to the non-economist. For the purposes of this paper, we have attempted to minimize the use of professional jargon and mathematics and have focused on the basic principles of a formula approach.

Background: There are a variety of possible formulas to govern contributions of state revenues to the Permanent Fund. The simplest is, of course, a fixed percentage of state petroleum leasing revenues. Such a formula would build up the balance in the Permanent Fund at a relatively predictable rate, but it would ignore current as well as future state budget needs. A constant percent contribution, for example, could leave large balances accumulating in the general fund over the next several years; but it could also, within a decade, begin to cause substantial general fund deficits in succeeding years.

Another formula, although more complicated, could be constructed with the objective of stipulating that Permanent Fund earnings provide a specified percentage of state revenues by a certain date. If, for example, the goal of the Permanent Fund was to provide 25 percent of the state's revenue needs in perpetuity by the year 2000, the purpose of the formula would be to determine the annual contributions to the Permanent Fund required to accomplish this goal.

A third and similarly complex alternative formula could be devised with the objective of providing for a smooth, orderly growth of money available in the general fund in order to meet the operating needs of state government for the longest possible period. And a fourth alternative formula could conceivably be designed whose purpose was "countercyclical," that is, encouraging reduced general fund spending in boom times and increased spending during recessions in the state's economy.

Revenues contributed to the Permanent Fund under any kind of formula are kept outside the normal budgetary process in that they are not available for normal state expenditures. Thus, it follows that the larger the contributions to the Permanent Fund in any year, the less general fund revenues available for expenditures and vice versa. To the extent that the legislature limits each year's appropriation to the revenues available that year to the general fund, the Permanent Fund contribution becomes the key policy variable controlling spending from the general fund. Indeed, because state spending is a major factor in the state economy, Permanent Fund contributions must also be viewed a key policy variable affecting the state's economic growth and population.

An Illustrative Formula: Although ISER is now modeling the impact of such alternative formulas on the state budget and the Alaskan economy, for the purpose of illustrating the use of such formulas, the present memo concentrates on the third type of formula, that is, one which would allow a smooth and orderly growth of general fund spending by putting all revenues in excess of the projected current needs of state government into the Permanent Fund.

A smooth, orderly growth of state expenditures is one which reflects the normal growth of demand by Alaskan residents for the services of state government, the income transfers, such as payments under the public assistance program, and the expenditures of local government, to the extent these later two are supported by general fund expenditures. In absolute dollar terms, this demand for state expenditures will tend to grow in response to three factors: 1) growth of the Alaska population; 2) inflation; and, 3) growth of real income per capita.

Any formula governing Permanent Fund contributions which is intended to allow a smooth and orderly growth in the money available in the general fund will have to reflect these three factors as well as unanticipated new ones such as a significant disaster. If contributions to the Permanent Fund allow general fund surpluses to grow, the legislature will come under pressure to spend them. Conversely, if the formula does not leave money in the general fund sufficient to keep up with the demand in state services, the legislature will soon be compelled to "break" the formula.

It is not difficult in principle to come up with a formula to estimate the money needed in the general fund in a given fiscal year. One plausible formula for a target rate of growth in state spending would be one which formulates that the rate of growth of state expenditures (rEX) will be equal to the rate of growth in the population (rPOP) plus the rate of growth in prices (rPRICE) plus the rate of growth of personal income per capita (rYPC). Expressed mathematically, the formula would be the following:

$$rEX = rPOP + rPRICE + rYPC$$

According to the formula, a 5 percent increase in state population or a 5 percent increase in the price level or a 5 percent increase in real personal income would each require a 5 percent increase in general fund appropriations if the existing quantity and quality of state services were to be maintained. Correspondingly, if all three variables increased 5 percent, general fund appropriations would have to be increased 15 percent to provide commensurate services.

Experience over many years in other states indicates that citizens are not satisfied with a constant quantity and quality of state services. Rather, as time passed and real incomes increased, citizens expected more and better services from state government and demanded higher levels of real spending per capita. In other words, the demand for state services rose disproportionate to rise in real per capita income. This disproportionate demand for services as incomes rise is captured by the concept of the "income elasticity of demand" for state spending and can be mathematically expressed by the symbol e.[1] Modifying the above formula to allow for the "income elasticity of demand," it becomes: $rEX = RPOP + rPRICE + rYPC(e)$.

---

[1]The income elasticity of demand is defined as the percentage rise in demand for services per one percent rise in real per capita income.

Thus, if the "income elasticity of demand" is estimated to be 1.2, a 5 percent rise in real personal income would result in a 6 percent increase in state spending per capita. ISER is presently investigating state expenditure data from other states in an effort to determine a reasonable income elasticity value for Alaska and will incorporate the value in its quantitative analyses.

None of the three factors determining the target rate of state spending does, in fact, move at a constant rate from year to year, and a target based on average growth rate established in previous years is likely to be "too high" in some years and "too low" in others. This need not be fatal, however, because the impact of population growth, inflation and higher citizen expectations tend to determine state expenditure patterns only over the long run and with some lag in any case. The kind of formula suggested here is, moreover, self-correcting to a large extent because any base expenditure figure selected (EX (t-2)) and the three commensurate growth rates can and would be continually updated as more recent information becomes available.

Conceivably, the legislature could find that the target figures are consistently too high or too low for several years running and that a persistent deficit or surplus was being built up in the general fund. For this reason, legislation establishing a formula might provide for redetermination of parameter e in the formula at periodic intervals--for example, every five years.

The preceding formulas establish only the target expenditures for each fiscal year. They do not by themselves establish the amount of the fiscal year surplus or deficit or the proportion of the surplus to be deposited in the Permanent Fund. To determine the size of the current fiscal year's surplus or deficit, we need to know what total state revenues will be, for both petroleum and non-petroleum sources. If the Permanent Fund contribution is to be determined in advance of the legislative budgeting process, it will be necessary to establish a definitive projection of state revenue and subtract from that projection the expenditure target for state spending. This approach adds another potential source of error to calculation (the revenue projection) and increases the risk that the formula approach would not in fact limit current spending sufficiently or, alternatively, would create irresistible pressures upon the legislature to "break" a formula they felt was intolerably restrictive.

A more workable approach might be to provide that all revenues, except the constitutionally mandated 25 percent of non-recurring mineral revenues that must be contributed to the Permanent Fund, accrue to the general fund up to the point at which general fund revenues equal fiscal year spending target. Once that level has been reached, all revenues from whatever source would be contributed to the Permanent Fund or to a contingent general fund reserve which could be called upon when a given year's target expenditures exceed the revenue remaining in the general fund after the mandatory contributions to the Permanent Fund and the other contingent

liabilities have been made. Under this approach, the legislature would not know in advance exactly how much money would be available in the general fund nor how much the Permanent Fund would be enhanced during the year. In its deliberations on the budget, both of these items would have to be estimated, and miscalculation for unforeseen developments would result in unexpected general fund deficits or surpluses which would carry over to later years. But, of course, that is exactly the situation that exists today.

Using a formula approach to Permanent Fund contributions, we would expect these contributions to be considerably more than half of petroleum revenues the state will receive over the next few years. Absent major new oil and gas discoveries on the state land or very large increases in real energy prices, the proportion to be contributed to the Permanent Fund could be expected to fall to a level below 25 percent by the mid-1990s. Eventually, the objective in maintaining smooth, orderly growth of monies available in the general fund would require withdrawals of accumulated earnings and ultimately of capital from the Permanent Fund. At some time in the future, therefore, the formula approach would no longer be viable, but the original concept of the Permanent Fund and its constitutional basis would have to be revised at that point in any case and this legal issue would likely be one of the least of Alaska's problems. The approach described here would be likely to postpone that day for the longest feasible time.

While the above illustration of a formula might create a "regularity" in the growth of state expenditures, it also serves to illustrate two serious limitations of a simple formula approach. First, such a formula fails to account for the long run viability of the chosen policy in the face of a depletable resource, and second, the formula might produce undesirable policy consequences should the economy enter a downturn. For example, the failure to consider the stabilization aspects of state expenditure policy by using such a formula would lead to declines in state expenditures at precisely the times when increases might be justified to offset the downward cyclical effect of, say, declines in pipeline construction.

Because of these limitations, it is essential that alternative formulas or rules be tested in policy simulations designed to anticipate the consequences of alternative rule specifications on both the short and long term growth of the Alaska economy. The ISER econometric model is designed to accomodate such alternative specifications and to test them.

ISER is completing several applications of the formula and will have the results available for the committee's review at its next meeting. As structured, both formula and the data sets related thereto are computerized and can be easily restructured to analyze the effect of policy choices the committee may wish to examine, such as allowing a 5 percent increase in state spending net of the formula's computation.

Professor Scott Goldsmith is the principal architect of the computer model and has served as the principal liaison with the committee. He is interested and willing to continue working with the committee in its efforts to assess the impacts of varying contributions to the Permanent Fund and of the Fund's investment options.

LG/m

PLEASE NOTE: THE FOLLOWING PAGES WERE TREATED AS A UNIT IN THE ORIGINAL DOCUMENT.

Alaska State Legislature

SPECIAL COMMITTEE ON
THE ALASKA PERMANENT FUND
(907) 276-3433
528 W. 5TH, SUITE 270
ANCHORAGE, AK. 99501
[POUCH V, JUNEAU, AK. 99811]
(907) 465-3873

House of Representatives

TO: The Honorable Clark Gruening August 22, 1977
Chairman
House Special Committee on the Permanent Fund

FROM: Mike Doogan
Committee Administrative Assistant

RE: Proposed Committee Contract with ISER (attached)

The following are changes I recommend after discussions with Jim Edenso, Jim Rhode, Gregg Erickson, and Lee Gorsuch.

That either: Clause I (A) be dropped from the contract
Clause I (A) (1) be amended to read: The Contractor shall review the investment of that part of the 1970 general fund balance placed with Alaska banks with the purpose of determining the policies which guided that investment and the extent to which those policies were directed at influencing the rate and direction of growth in the Alaska economy or sectors thereof.

The amendment is recommended because all concerned agree that there is insufficient data to trace any money other than that placed with the banks, the loan money and capital expenditures voted by the legislature being virtually untracable.

Dropping the clause is recommended because simply studying the $118 million placed with Alaska banks does not tell us anything, unless we need the information in considering whether the investment portion of the fund in HB 300 be placed through local banks.

****

That Clause (B) and Clause (C) be switched.

My reading of the contract makes the work in the current Clause (C) necessary before the work in the current Clause (B) is done.

****

That the rearranged Clause (B)--the current Clause (C)--be amended to include a formula for contribution, such as the one you have been considering.

Jim Rhode points out, and I agree, that the formula would make all revenue (not just the revenue called for in the constitutional amendment) subject to contribution to the Permanent Fund after, of course, the budget rate of growth had been set.

****

That the rearranged Clause (C)--the current Clause (B)--be amended to include inflation as a (4) and the current (4)--any other regional economic indicators that the Contractor may consider relevant--be made (5).

no can do

That (this is at the end of the current Clause (B)) a (4) be added measuring the effects of the earnings being used in both hard and soft loan programs in the state. This might also be accomplished by changing the wording in (1).

These additions are considered necessary to plan for all possible contingencies.

****

already there

That Clause (D) be amended to read: For each of the projects, the Contractor will trace the impacts of the investment in terms of gross and net changes in employment levels, personal income, state and local taxes, and population.

Only by attempting to determine gross and net changes will we be able to discover the impact on current Alaskans of these projects.

DRAFT

CONTRACT BETWEEN

STATE OF ALASKA

DEPARTMENT OF REVENUE

AND

UNIVERSITY OF ALASKA

INSTITUTE OF SOCIAL AND ECONOMIC RESEARCH

The parties of this agreement are the STATE OF ALASKA, DEPARTMENT OF REVENUE, on behalf of the Legislative Committees on the Permanent Fund, hereinafter referred to as the "Department", and the UNIVERSITY OF ALASKA, INSTITUTE OF SOCIAL AND ECONOMIC RESEARCH, hereinafter referred to as the "Contractor".

THE PURPOSE OF THIS AGREEMENT is to provide the Legislature and the State with expert economic information on the expected effects of selected permanent fund management strategies.

IT IS THEREFORE MUTUALLY AGREED THAT:

CLAUSE I. - STATEMENT OF WORK

(A)

(1) The Contractor shall review the policies which guided investment of the large general fund balance that developed in FY 1970, and identify the extent to which those policies were directed at influencing the rate and direction of growth in the Alaska economy or sectors thereof. Reference should be made to (a) the stated or recollected intentions of policy makers; and (b) the actual fiscal strategies pursued ~~as determined under (A)(2) of this clause~~.

(2) The Contractor shall determine the chronology of those investments or other general ~~fund~~ management actions that had or were expected ~~to~~ have a direct impact on the Alaska economy ~~of their performance, including~~ but not limited to

(3) The Contractor shall estimate, to the extent published banking statistics and other economic data permit, the actual impact of these actions, ~~identified under (A)(2) of this clause~~, identifying the possible sources and degree of uncertainty associated with this estimate. Included with this estimate shall be (a) a discussion of any capital substitution effects inferred from the data; (b) an assessment of any income redistributions resulting from the investment policies; and (c) calculations of the state's opportunity costs as measured by the actual returns on "outside" investments earned during comparable periods.

(4) The Contractor shall prepare and submit a written analysis of its findings under (A)(1) - (A)(3) above.

(B) The Contractor shall review the "Alaska Inc." proposal embodied in HB 525-SB 384 (Tenth Legislature) and provide written estimates over a twenty-year period of the effects the proposal would have on (1) personal income; (2) levels of employment; (3) population; and (4) any other regional economic indicators that the Contractor may consider relevant. In making these estimates, it is recognized that assumptions will need to be made concerning, inter alia, future personal consumption and saving patterns. It is recognized that qualitative judgment will be the source of many of these assumptions; however, each assumption shall be made explicit, as shall the reasons for making it. In addition, the Contractor shall estimate and report in writing on comparable effects of (1) retaining earnings in the permanent fund; (2) using fund earnings to lower personal income taxes; and (3) spending fund earnings as supplemental general fund revenues.

(C) The Contractor shall prepare a written report assessing the long-term economic and fiscal impacts of varying the amount of contributions paid into the permanent fund. Included in the report shall be an examination of minimum, maximum and intermediate levels of contributions to the fund and--assuming state expenditures consume the revenues remaining after permanent fund contributions--estimated impacts on (1) personal income; (2) population growth; (3) employment levels; and (4) permanent fund and general fund balances. In addition, the Contractor will devise a means for estimating contribution levels which would, by adjustment of appropriate co-efficients, leave sufficient general fund revenues to meet any legislatively pre-established level of real expenditure growth. Correspondingly, the contractor will also devise a means for estimating contribution levels that would generate sufficient earnings to accommodate predetermined proportions of the state's forecasted revenue requirements.

(D) The Contractor shall prepare and submit a written analysis of the economic and fiscal impacts of permanent fund investments in two hypothetical projects from distinct seciors of the Alaska economy. One project would be state investments in hatcheries and stream enhancement, directed at increasing salmon harvests as outlined in the report, The Economic Feasibility of Private Non-Profit Hatcheries by F. L. Orth. The second project would involve an investment in a petro-chemical facility. The details of the petro-chemical facility will be prepared by the Contractor in consultation with the Project Director. For each of the projects, the Contractor will trace the impacts of the investment in terms of changes in employment levels, personal income, state and local taxes, and population.

CLAUSE II. - PERIOD OF PERFORMANCE

(A) Work under this contract shall be performed between 15 August 1977 and 15 December 1977, and shall be completed in order of task listing, with all tasks to be completed by 15 December 1977.

(B) This contract may be terminated by written notice of either party to the other. In the event of termination by the Department, the Contractor shall receive a lump sum payment determined by multiplying the contract price ($30,000) times the proportion of the total work completed by the Contractor. In the event of termination by the Contractor, this amount shall be reduced by one-half.

CLAUSE III. - PROJECT DIRECTOR

The Project Director shall be Representative Clark Gruening, Chairman, Subcommittee on the Alaska Permanent Fund (House).

CLAUSE IV. - COMPENSATION AND METHOD OF PAYMENT

(A) Contractor's compensation for the work specified in Clause I shall be $30,000, payable on completion of project (all four tasks), except that this amount shall be reduced by 10% if the work specified in Clause I is not delivered by the date specified in Clause II (15 December 1977), and by a further 1% of the contract price for each day of further delay.

(B) Expenses incurred by the Contractor in the completion of the work set forth in Clause I shall be borne by the Contractor.

CLAUSE V. - RECORDS, DOCUMENTS, AUDIT

(A) The Contractor shall maintain accurate records as may be required by the Project Director. The records are subject to inspection by the Department or the Project Director at all reasonable times.

(B) All documents, reports and writings generated as a consequence of work done under this contract shall become the property of the State of Alaska, and on completion of the work or at the termination of this contract duplicate copies shall be delivered to the Project Director and to the Department.

CLAUSE VI. - REPORTS

The Contractor shall keep the Project Director informed as to the progress of the work performed under this agreement and shall provide progress reports as specified by him. A copy of each report shall be delivered to the Project Director, the Deputy Commissioner of Revenue (Treasury) and to the chairman of the Subcommittee on the Alaska Permanent Fund (Senate).

CLAUSE VII. - ALL WRITINGS CONTAINED HEREIN

This agreement contains all the terms and conditions agreed upon by the parties. No other understandings, oral or otherwise, regarding the subject matter of this agreement shall be deemed to exist or to bind either of the parties of this agreement.

IN WITNESS WHEREOF, the parties have executed this agreement on the dates noted.

UNIVERSITY OF ALASKA, INSTITUTE OF SOCIAL AND ECONOMIC RESEARCH		STATE OF ALASKA DEPARTMENT OF REVENUE	
E. LEE GORSUCH	Date	JAMES EDENSO	Date

Accepted:

CLARK GRUENING, Chairman Subcommittee on the Alaska Permanent Fund (House)	Date

Put in Penalty Clause.

DRAFT

CONTRACT BETWEEN

STATE OF ALASKA

DEPARTMENT OF REVENUE

AND

UNIVERSITY OF ALASKA

INSTITUTE OF SOCIAL AND ECONOMIC RESEARCH

The parties of this agreement are the STATE OF ALASKA, DEPARTMENT OF REVENUE, on behalf of the Legislative Committees on the Permanent Fund, hereinafter referred to as the "Department", and the UNIVERSITY OF ALASKA, INSTITUTE OF SOCIAL AND ECONOMIC RESEARCH, hereinafter referred to as the "Contractor".

THE PURPOSE OF THIS AGREEMENT is to provide the Legislature and the State with expert economic information on the expected effects of selected permanent fund management strategies.

IT IS THEREFORE MUTUALLY AGREED THAT:

CLAUSE I. - STATEMENT OF WORK

(A)

$1/8 million - not include investments outside

(1) The Contractor shall review the policies which guided investment of the large general fund balance that developed in FY 1970, and identify the extent to which those policies were directed at influencing the rate and direction of growth in the Alaska economy or sectors thereof. Reference should be made to (a) the stated or recollected intentions of policy makers; and (b) the actual fiscal strategies pursued, as determined under (A)(2) of this clause.

(2) The Contractor shall determine the chronology of those investments or other general fund management actions that had or were expected to have a direct impact on the Alaska economy.

(3) The Contractor shall estimate, to the extent published banking statistics and other economic data permit, the actual impact of the actions identified under (A)(2) of this clause, identifying the possible sources and degree of uncertainty associated with this estimate. Included with this estimate shall be (a) a discussion of any capital substitution effects inferred from the data; (b) an assessment of any income redistributions resulting from the investment policies; and (c) calculations of the state's opportunity costs as measured by the actual returns on "outside" investments earned during comparable periods.

CED doing

(4) The Contractor shall prepare and submit a written analysis of its findings under (A)(1) - (A)(3) above.

(B) The Contractor shall review the "Alaska Inc." proposal embodied in HB 525-SB 384 (Tenth Legislature) and provide written estimates over a twenty-year period of the effects the proposal would have on (1) personal income; (2) levels of employment; (3) population; and (4) any other regional economic indicators that the Contractor may consider relevant. In making these estimates, it is recognized that assumptions will need to be made concerning, inter alia, future personal consumption and saving patterns. It is recognized that qualitative judgment will be the source of many of these assumptions; however, each assumption shall be made explicit, as shall the reasons for making it. In addition, the Contractor shall estimate and report in writing on comparable effects of (1) retaining earnings in the permanent fund; (2) using fund earnings to lower personal income taxes; and (3) spending fund earnings as supplemental general fund revenues.

(C) The Contractor shall prepare a written report assessing the long-term economic and fiscal impacts of varying the amount of contributions paid into the permanent fund. Included in the report shall be an examination of minimum, maximum and intermediate levels of contributions to the fund and--assuming state expenditures consume the revenues remaining after permanent fund contributions--estimated impacts on (1) personal income; (2) population growth; (3) employment levels; and (4) permanent fund and general fund balances. In addition, the Contractor will devise a means for estimating contribution levels which would, by adjustment of appropriate co-efficients, leave sufficient general fund revenues to meet any legislatively pre-established level of real expenditure growth. Correspondingly, the contractor will also devise a means for estimating contribution levels that would generate sufficient earnings to accommodate predetermined proportions of the state's forecasted revenue requirements.

(D) The Contractor shall prepare and submit a written analysis of the economic and fiscal impacts of permanent fund investments in two hypothetical projects from distinct sectors of the Alaska economy. One project would be state investments in hatcheries and stream enhancement, directed at increasing salmon harvests as outlined in the report, The Economic Feasibility of Private Non-Profit Hatcheries by F. L. Orth. The second project would involve an investment in a petro-chemical facility. The details of the petro-chemical facility will be prepared by the Contractor in consultation with the Project Director. For each of the projects, the Contractor will trace the impacts of the investment in terms of changes in employment levels, personal income, state and local taxes, and population.

CLAUSE II. - PERIOD OF PERFORMANCE

(A) Work under this contract shall be performed between 15 August 1977 and 15 December 1977, and shall be completed in order of task listing, with all tasks to be completed by 15 December 1977.

(B) This contract may be terminated by written notice of either party to the other. In the event of termination by the Department, the Contractor shall receive a lump sum payment determined by multiplying the contract price ($30,000) times the proportion of the total work completed by the Contractor. In the event of termination by the Contractor, this amount shall be reduced by one-half.

CLAUSE III. - PROJECT DIRECTOR

The Project Director shall be Representative Clark Gruening, Chairman, Subcommittee on the Alaska Permanent Fund (House).

CLAUSE IV. - COMPENSATION AND METHOD OF PAYMENT

(A) Contractor's compensation for the work specified in Clause I shall be $30,000, payable on completion of project (all four tasks), except that this amount shall be reduced by 10% if the work specified in Clause I is not delivered by the date specified in Clause II (15 December 1977), and by a further 1% of the contract price for each day of further delay.

(B) Expenses incurred by the Contractor in the completion of the work set forth in Clause I shall be borne by the Contractor.

CLAUSE V. - RECORDS, DOCUMENTS, AUDIT

(A) The Contractor shall maintain accurate records as may be required by the Project Director. The records are subject to inspection by the Department or the Project Director at all reasonable times.

(B) All documents, reports and writings generated as a consequence of work done under this contract shall become the property of the State of Alaska, and on completion of the work or at the termination of this contract duplicate copies shall be delivered to the Project Director and to the Department.

CLAUSE VI. - REPORTS

The Contractor shall keep the Project Director informed as to the progress of the work performed under this agreement and shall provide progress reports as specified by him. A copy of each report shall be delivered to the Project Director, the Deputy Commissioner of Revenue (Treasury) and to the chairman of the Subcommittee on the Alaska Permanent Fund (Senate).

CLAUSE VII. - ALL WRITINGS CONTAINED HEREIN

This agreement contains all the terms and conditions agreed upon by the parties. No other understandings, oral or otherwise, regarding the subject matter of this agreement shall be deemed to exist or to bind either of the parties of this agreement.

IN WITNESS WHEREOF, the parties have executed this agreement on the dates noted.

UNIVERSITY OF ALASKA, INSTITUTE OF SOCIAL AND ECONOMIC RESEARCH		STATE OF ALASKA DEPARTMENT OF REVENUE	
E. LEE GORSUCH	Date	JAMES EDENSO	Date

Accepted:

CLARK GRUENING, Chairman Date
Subcommittee on the
Alaska Permanent Fund (House)

PLEASE NOTE: THE PRECEDING PAGES WERE TREATED AS A UNIT IN THE ORIGINAL DOCUMENT.

School of Management

Alaska Sea Grant Program
University of Alaska
Fairbanks, Alaska

The Economic Feasibility of Private Nonprofit Salmon Hatcheries

F. L. ORTH

SEA GRANT REPORT 77-4
JUNE 1977

This publication is the result of research sponsored by the Alaska Sea Grant Program, cooperatively supported by NOAA Office of Sea Grant, Department of Commerce, under Grant #04-7-158-44006 and by the University of Alaska with funds appropriated by the State of Alaska.

THE ECONOMIC FEASIBILITY OF PRIVATE NONPROFIT SALMON HATCHERIES

F. L. Orth

Alaska Sea Grant Program
University of Alaska
Fairbanks, Alaska

Sea Grant Report 77-4
June 1977

TABLE OF CONTENTS

Contents

LIST OF FIGURES

LIST OF TABLES

ABSTRACT

In recent years Alaska's salmon fisheries have been in a severely depressed state. Proposals for restoration range from complete closures of commercial salmon fisheries to crash enhancement programs. The latter has in its favor that it is a positive approach which would rely on modern scientific and engineering knowledge to enhance the natural productivity of a fishery. Nevertheless, economic uncertainties, deriving from biological as well as economic variables, and the need for institutional experimentation caution for a moderate and reasoned pace of development.

This report evaluates the economic feasibility of salmon enhancement production (as opposed to research) units for one institutional form--the private nonprofit firm. Limited inferences about other institutional forms are made as well. The analysis of economic feasibility proceeds from generalizations about the economic incentives facing potential developers of nonprofit salmon ranching firms, primarily fishermen, to specific quantitative statements based on a pilot study of the Port San Juan hatchery of the Prince William Sound Aquaculture Corporation. These generalizations about economic incentives and quantitative statements about feasibility are then related to present and proposed public policies toward salmon enhancement in Alaska.

Economic incentives to invest private funds in salmon ranching ventures are reduced by the free-rider problem and extreme uncertainty. The latter is exacerbated by failure of the public sector to clearly establish policies which allow reasonable estimates of private benefits.

The following conclusions concerning the economic feasibility of private nonprofit salmon ranching ventures are based on present knowledge about biological

productivity, costs (as established for the first hatchery of the Prince William Sound Aquaculture Corporation), and price: Hatchery investments will yield positive net economic returns to the common-property fishery and fishing communities at 1) eighty percent egg survival, 2) slightly greater than two percent ocean survival, and 3) the 1976 price of pink salmon in Cordova, Alaska. However, under these conditions, hatchery firms cannot generate sufficient revenues from the sale of surplus fish to cover the costs of all resources employed in the production process. The survival of private nonprofit firms, therefore, will require assessment payments from those common-property fishing units benefiting from the hatchery runs. The existence of positive net economic benefits to the common-property fishery establishes the economic justification for an assessment program.

The adverse effects on economic incentives caused by the free-rider problem and uncertainty may discourage nonprofit firms from being formed and necessary assessment programs from being arranged. Given that the State of Alaska has decided to produce salmon through enhancement efforts, and that hatchery investments appear on the basis of present information to be economically feasible, state incentive subsidies to the private sector to create and operate enhancement production units are both economically justified and will require significantly smaller outlays of public funds than the creation and operation of comparable production units by the state. Furthermore, private nonprofit hatchery units will have relatively strong economic incentives to be efficient and to discover cost-saving and productivity-increasing techniques, a characteristic which holds the potential for significant long-run benefits. The relative merits of two additional institutional forms, not presently allowed by statute, are discussed.

ACKNOWLEDGEMENTS

The author wishes to acknowledge the contributions of others to the research effort embodied in this report. The Prince William Sound Aquaculture Corporation generously agreed to provide data and Armin Koernig, President, deserves special recognition for his support and his constant urging that the research be made relevant to the decision-making process within salmon hatchery firms as well as to the public sector. Mark Kazazean, Business Manager, and Deniva Jones, Accountant, assisted the author with data collection. Mark Kazazean wrote a summary of the major pieces of equipment, by function, that were required at the Port San Juan hatchery. This summary appears as Appendix Table A-1. Wallace Norenberg, consulting biologist to the Prince William Sound Aquaculture Corporation, assisted the author in becoming educated about the biological dimensions of salmon enhancement production units.

Special appreciation is extended to the following individuals for their thorough and thoughtful review of an earlier draft of this report: Kwang Im, Economist, Oregon State University; E. Thomas Robinson, Assistant Professor, Department of Accounting, University of Alaska; Donald H. Rosenberg, Director, Alaska Sea Grant Program; Wayne Thomas and Bill Workman, Economists, Agriculture Experiment Station, University of Alaska; and Jack Van Hyning, Private Biological Consultant. Any errors or omissions are the sole responsibility of the author.

Finally, the contributions of several members of the staff of the Alaska Sea Grant Program are gratefully acknowledged: John Martin, presently a graduate student at Oregon State University, assisted with the collection of cost data and evaluating revenue flows under alternative sets of assumptions; Nina Hussey cheerfully bore the

entire burden of typing the manuscript; and the fine editing work of Fran Sweet is also thankfully recognized.

CHAPTER I

PRIVATE NONPROFIT HATCHERY FIRMS AND ECONOMIC INCENTIVES

Introduction

Presented in this report is an analysis of the economic feasibility of private nonprofit ocean-ranching ventures. Qualified generalizations concerning feasibility are derived from a pilot study of the Prince William Sound Aquaculture Corporation's (PWSAC) hatchery facility at Port San Juan on Evans Island in Prince William Sound, Alaska. The Evans Island hatchery, the construction of which was approximately eighty percent complete by year end 1976, has a designed capacity of 25 million pink or chum salmon eggs per year and is the first of several hatcheries in a plan to create a total salmon incubation capacity of 300 million eggs per year in Prince William Sound.

Since the formation of PWSAC in 1974, five additional nonprofit hatchery firms have received site permits and eight permit applications are outstanding as of December, 1976 (Lindstrom, 1977). The only other private nonprofit hatchery in place is a two million egg facility constructed by Sheldon Jackson Community College in Sitka, Alaska. As its size and location suggest, this hatchery is primarily intended as an educational, rather than a production, hatchery. Nevertheless, the college is depending on revenues from the sale of surplus returning adult salmon to help defray the cost of the program, and there are plans to expand this facility to a capacity of six-to-ten million eggs (Lindstrom, 1977).

Beginning with enabling legislation in 1974, the Alaska Legislature has attempted to develop an atmosphere conducive to private nonprofit hatchery development. The 1975 Alaska Legislature extended the state's small business loan program to hatchery firms. This financing assistance was replaced by the 1976 legislature with a much larger loan program designed exclusively for private nonprofit hatchery firms.[1] There is every reason to believe that the state's policy toward private sector involvement in salmon enhancement will continue to evolve as knowledge is gained and as problems are presented for solution through the political process.

Alaska had an early and unspectacular history of efforts to enhance salmon stocks (McNeill and Bailey, 1975). This fact, along with adverse economic incentives, probably explains why Alaska has been relatively slow, compared to other salmon producing states in the Pacific Northwest, Japan and Canada, in responding to depressed salmon stocks through enhancement efforts. In 1972 the Division of Fisheries Rehabilitation, Enhancement and Development (FRED Division) was formed within the Alaska Department of Fish and Game (ADF&G). This unit is responsible for all public commercial salmon-enhancement activities and for assisting private hatchery firms in various ways (Orth, 1976b). A description of existing and planned facilities may be found in the FRED Division's report to the 1977 Alaska Legislature (Alaska Department of Fish and Game, 1977).

The State of Alaska, then, presently has a public and private-sector salmon hatchery program. This duality will be considered in Chapter III because it

---

[1]For a compilation of these statutes see E. Thomas Robinson, Alaska Statutes: Commercial Fishing Loan Act, Salmon Hatcheries and Fisheries Enhancement Loan Program, *Aquaculture Notes* November 1976.

implicitly raises questions concerning the viability and general applicability of the private nonprofit enhancement approach, the distribution of the benefits from and costs of salmon enhancement, and the possible displacement of other policy options with respect to institutional forms.

Approach

The feasibility analysis presented in this report has been conducted in a manner designed to focus on the explicit and implicit policy issues associated with Alaska's salmon enhancement program. This approach was adopted because the primary alternative, a narrowly focused feasibility analysis of a particular hatchery investment, is of relatively limited interest, would not be of representative value (for reasons discussed below) for all or most ocean ranching investments in Alaska, and for both these reasons would be of little value to the public decision-making process. It was decided instead to use the pilot study of the Port San Juan hatchery as a vehicle for drawing out and suggesting alternative courses of action for important policy issues.

Accepted economic theory played at least an equal role with empirical measurement in this report. The reason that empirical measurement of the dimensions of economic feasibility at the Port San Juan site did not serve as the sole basis for drawing conclusions about feasibility and the policy issues associated with it is that the Port San Juan hatchery is not entirely representative; each hatchery site and each hatchery firm will have unique physical and institutional characteristics. In addition to uniqueness, there are several other reasons why the cost figures shown in this report may not be representative. First, when this study was conceived, 1975

was believed to be the first production year, not 1976 as actually transpired. For this reason, *estimates* of operating costs were utilized instead of cost data based on actual operating experience. The same is true, in lesser degree, of construction cost information. Second, the first PWSAC hatchery was constructed using an old set of buildings that once made up a fish-processing facility. This site was chosen because it was the only potential site in Prince William Sound located on patented land; all other potential sites would have required U.S. Forest Service permits, the acquisition of which at the time would have required months of delay and considerable expense. Third, initial engineering reports were somewhat misleading with respect to the investment required to upgrade the existing buildings for use as a hatchery complex. It is now believed that a hatchery site developed from the ground up would have been considerably less costly. Fourth, the PWSAC development has occurred over a period of time in which considerable uncertainty existed with respect to the most desirable incubator and egg tray design. Future hatcheries will be developed under conditions of less uncertainty and this should allow a reduction in costly experimentation. Finally, and perhaps most important in terms of the impact on cost, is the fact that PWSAC was the first hatchery firm to actually develop a hatchery under the state's nonprofit hatchery program. Consequently, it had to break new ground for a *production* hatchery in engineering, construction, incubator design, beneficiary-group organization, nonprofit firm management organization and financing. In addition, PWSAC has been very active politically in attempts to obtain those modifications in the state's policies which it considered essential to the survival of nonprofit hatchery firms. The resultant travel cost and opportunity cost of top management's time has been substantial.

It would appear that development costs associated with "newness" will decline with each succeeding nonprofit hatchery firm. As for PWSAC, most of these costs are appropriately distributed over all hatcheries built. However, because it is uncertain whether additional hatcheries will be built, the approach utilized in this report is to charge all of the development costs incurred by PWSAC to the Port San Juan hatchery. While clearly debatable, it was judged that a conservative approach of not distributing these costs over *planned* hatcheries would be prudent at this stage of the development of Alaska's private hatchery program.

Given these disclaimers, it is desirable to summarize the author's views as to what are the appropriate applications of the analyses contained in this report. First, as already stressed, is the use of feasibility analysis to draw out policy issues related to Alaska's public and private-nonprofit hatchery programs. Second, this analysis will suggest alternative courses of policy action and provide some of the information needed to evaluate them. Third, even though the cost experiences of the Port San Juan hatchery and PWSAC generally may not be representative in terms of specific values, they do provide order-of-magnitude estimates for the present formulative stage of the nonprofit hatchery program. Finally, this report has specific relevance to other hatchery firms for evaluating contemplated hatchery investments in that it presents a logical framework for evaluating the principal parameters of economic feasibility--biological factors, technology (costs), size and distribution of benefits, and institutional constraints.

Organization

The remainder of Chapter I will be devoted to an analysis of the economic incentives presently facing existing members and potential entrants of the private salmon enhancement "industry." Since this analysis has been presented elsewhere (Orth, 1975, 1976a, 1976b) it will only be summarized here. Chapter II contains a presentation of the feasibility analysis of PWSAC's Evans Island hatchery. Chapter III considers the efficiency and equity implications of public investment in private nonprofit hatcheries and in public hatcheries. Chapter IV summarizes and concludes this report.

Economic Incentives

The economic incentives facing potential investors in salmon hatcheries diverge significantly from those generated by less complex market environments. This divergence can be explained by vaguely-defined property rights, free-rider problems, and extreme uncertainty. The implications of each of these factors for investment incentives are discussed below.

Property Rights

Private property rights in artificially-propagated salmon stocks are primarily a function of institutional arrangements and economic forces. In the former category must be placed binational and multinational agreements, unilateral extended jurisdiction, and domestic limited-entry schemes. In the latter category must be placed the economic forces which, given the institutional arrangements, determine the amount of competitive fishing effort actually exerted in a particular area during a

fishing season. Property rights may also be affected by fish straying to other than the "home" stream, by fish passing through distant fisheries before returning to the area from which they were implanted, and at the processor level, by the entry into an area of "buyer boats" from other areas. The latter may reduce the incentive of processors in an area to contribute to hatchery investments.

Two general types of property-rights situations exist or potentially exist in Alaska's salmon fisheries. First, there is the case of the established regional fishery into which access is restricted. In this case individual permit-holding fishermen have limited property rights--limited by the degree of competition as determined by the number of fishing units allowed in an area under the limited-entry law; the greater the entry allowed,the less the average property right of individual fishermen. Given that the number of fishing units that are allowed to enter is constant over long periods, an individual fisherman would have an incentive to invest in stock enhancement activities as long as the incremental cost to him is exceeded by the expected incremental revenue, and the greater the excess the greater the incentive to invest.

Two generalizations follow from this situation: First, some form of joint action would be required to induce *shared* investment by entry-permit holders on the principle that because returns will be shared among a large number of independent units, costs must also be generally shared. The second generalization is that a "free-rider" problem exists which must be overcome in some way (e.g., peer pressure, social coersion, or subsidies) before effective joint action will be possible. Free riders are those who know that they cannot be excluded from benefiting from enhanced stocks if they do not contribute to the joint action, and the existence of free riders blunts the incentive of those who would otherwise contribute but who

do not want to pay for benefits enjoyed by noncontributors. A large number of free riders would have the effect of causing efforts to create joint action break down.

This first situation (an established fishery with restricted access), which is characteristic of all *established* Alaska salmon fisheries, favors private nonprofit hatchery firms supported financially by fishermen and processors (because external benefits -- those enjoyed by the offshore fishery[2] -- will be a large proportion of the total benefits). The free-rider problem is significant in all such cases, however, so that the public sector will probably need to become involved in some way to affect incentives for creating and financing nonprofit firms. Alternately, the public sector could invest directly in the construction and operation of state hatcheries, financing those investments from general revenues or specific taxes on beneficiaries. The justification for both forms of government intervention is considered in Chapter III.

The second type of property-rights situation exists in areas where there is no established fishery but where considerable physical potential for enhancement exists. In this situation, property rights to returning hatchery fish would initially be exclusive to the firm investing in a hatchery. The generalization which follows from this situation is that, since there is no established fishing fleet to form a nonprofit firm, either investment by private profit-seeking firms or the public sector would be required. However, the public sector would presumably have difficulty justifying hatchery investments in areas not having an established user group and private profit-seeking hatchery firms are not allowed under existing state law. Thus, even though biological and economic conditions might warrant development of such sites, present institutional arrangements will prevent their potential from being realized.

---

[2]The term "offshore fishery" is used here to mean the conventional seine and gill net fisheries, and it is contrasted with the harvest of salmon (whether by conventional means or not) by the shore-based hatchery.

In summary, property rights in artificially propagated fish accrue, in varying proportions depending upon the circumstances, to the hatchery firm and the offshore fishery, and indirect benefits from enhancement accrue to processors and regional economies. An important determinant of the success of the private nonprofit hatchery approach provided for under the statutes of the State of Alaska is the ability to obtain sufficient support among the beneficiary groups to form, and then support financially, a nonprofit hatchery firm.

The revenue and cost flows associated with private ocean-ranching ventures are depicted in Figure 1.

Uncertainty

A high degree of uncertainty is another factor affecting private incentives to invest in hatcheries. Uncertainty is derived from the unknowns surrounding the survival rate of hatchery fish in the natural environment, the difficulty of forecasting future market conditions for the inputs and the output of hatcheries, and the high degree of sensitivity of economic feasibility to both of these factors. Additional uncertainty derives from the instability of the evolving policies of the state with respect to resource management, the relative roles of the public and private hatchery programs and the methods and level of funding.

In short, there are few givens in the biological, technological, political,, and market dimensions with which a hatchery enterprise must be concerned. The combination of these uncertainties with those resulting from vaguely defined property rights and the free-rider problem creates an extremely uncertain economic environment for nonprofit hatchery firms. The practical significance of this uncertainty is, of

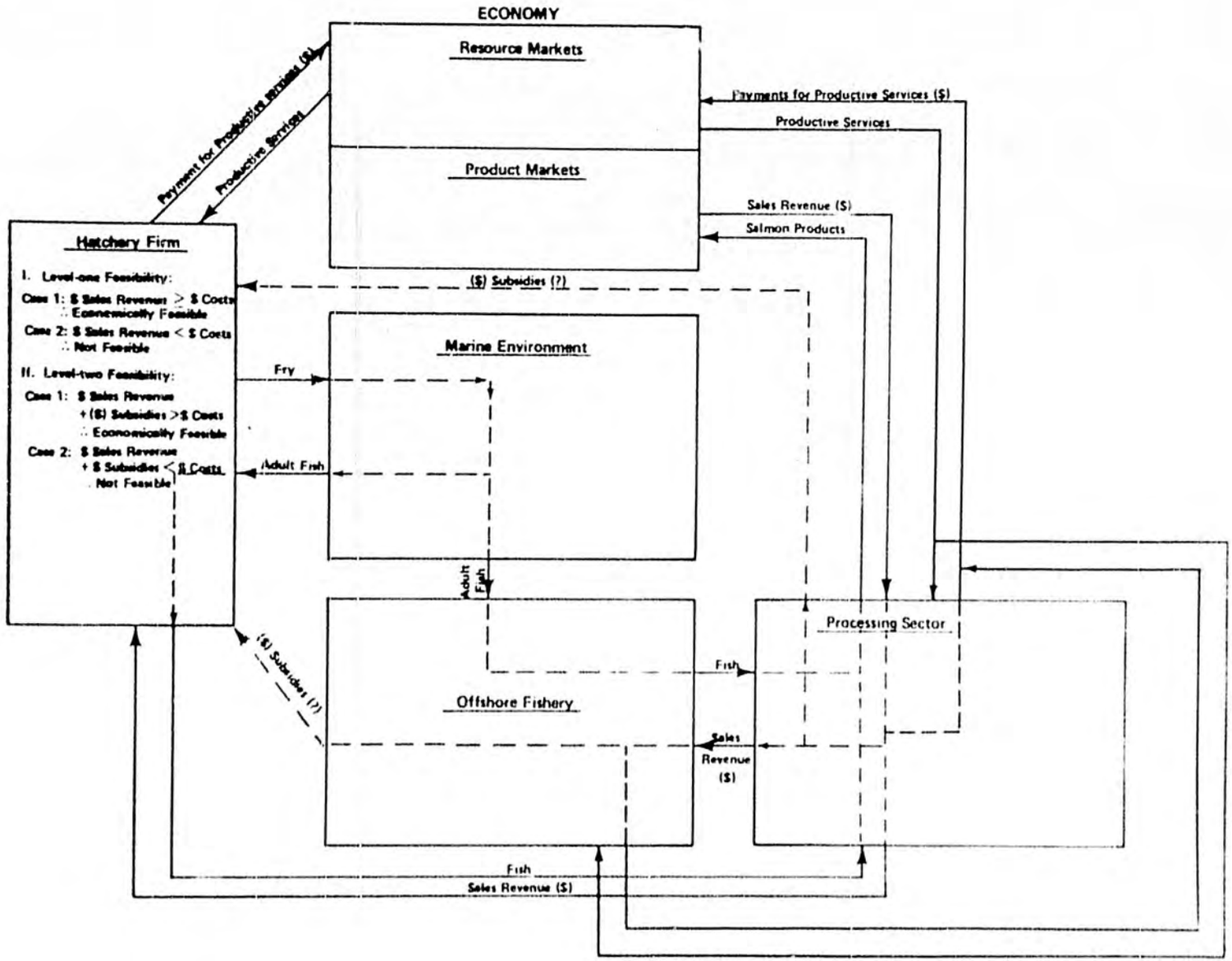


Figure 1. Revenue and Cost Flows of Hatchery Firms

course, that potential private investors (contributors) have little basis for projecting rates of return in comparison to other investment alternatives. Furthermore, the present nonprofit restriction forecloses the normal market mechanisms for obtaining high-risk capital and managerial talent (Orth, 1976a).

CHAPTER II

ECONOMIC FEASIBILITY OF THE PORT SAN JUAN HATCHERY

Introduction

The feasibility analysis presented in this chapter utilizes a conceptual framework that assigns three different meanings to the term "economic feasibility" in recognition of the fact that the benefits (revenues) *created* by a hatchery will, in normal circumstances, exceed the benefits (revenues) *received* by the hatchery firm. If one is willing to accept the proposition that economic feasibility exists when benefits (revenues) exceed costs, then the feasibility of a salmon hatchery may well turn on how broadly one defines benefits. For example, a hatchery investment might give rise to benefits (both internal and external) which greatly exceed its cost, and in this sense it is economically feasible, but, if the hatchery firm is not capable, under existing institutional arrangements, of internalizing sufficient of those external benefits to cover its costs, then the hatchery firm will not survive, and in this sense the investment would not be economically feasible. Identifying feasibility at several levels is a way of treating systematically the distinction between total benefits created and benefits received by the hatchery firm. Three criteria by which economic feasibility should be judged are apparent:

1. Level-one feasibility: Feasibility exists when the revenues received by the hatchery firm from the sale of surplus adult salmon are just equal to, or exceed, the opportunity cost of all resources required to construct and operate a hatchery. To carry out level-one feasibility analysis one must abstract from the

problem of sources of financing for the hatchery firm. The basic question being addressed is whether or not hatchery investments, however financed and however they are organized institutionally, are capable of earning a positive rate of return, one that is competitive with alternative investment opportunities. In areas where there is an established fishery and where, therefore, external benefits are large relative to internal benefits, level-one feasibility is very unlikely given present costs (technology) and present knowledge about biological returns to salmon hatcheries.

2. Level-two feasibility: Feasibility exists when the sum of the revenues received by the hatchery firm from the sale of surplus adult salmon, plus the non-sales revenue from fishermen and processor assessments and from grants, are just equal to, or exceed, the opportunity cost of all resources required to construct and operate a hatchery. Level-two feasibility is of practical interest in part because, at this level of analysis, it is appropriate to consider sources of financing explicitly. The quantitative difference between level-one and level-two feasibility is the amount of external subsidy required to insure feasibility.

One purpose of a formal distinction between levels of feasibility is to assist in establishing the amount of external support that may be required for each nonprofit hatchery investment to be economically feasible so that this amount can be compared to estimates of external benefits. Indeed, the economic criterion by which one would evaluate the justification for external support is that the dollar value of the external benefits must be equal to, or greater than, the amount of subsidy required. A crucial question remains, if subsidies are justified, concerning who should pay the subsidies and how their collection should be organized.

3. Level-three feasibility: Feasibility exists when the sum of benefits, primary (internal and external) and induced (external), is equal to or exceeds all costs associated with the construction and operation of a hatchery. This is the basic benefit-cost analytical framework that requires the estimation of induced economic benefits and costs in the local or regional economy,[1] as well as state-local tax revenue impacts.[2] The analysis of level-three feasibility is not undertaken in this study due to resource constraints and due to the considerable redundancy with level-two feasibility analysis. For reasons discussed elsewhere, level-three feasibility analysis will become crucial as Alaska's salmon hatchery program matures (Orth, 1975, p. 8). For the present, establishing level-two feasibility is probably sufficient to also establish the existence, but not the magnitude, of level-three feasibility (see p. 66).

Level-One Feasibility

Economic feasibility defined at "level one" encompasses only those revenues and costs that are internal to the hatchery firm. It excludes those revenues which accrue to the offshore fishery from the capture and sale of hatchery-originated salmon, and, on the cost side, it considers the opportunity cost of all resources used. The scope of the revenue and cost components of the analysis will subsequently be modified for level-two feasibility analysis.

---

[1] Induced benefits and costs are those occurring in sectors of the Alaskan economy other than those directly related to the salmon industry. The well-known and often exaggerated "multiplier" concept has its source in induced responses.

[2] It is also relevant for policy makers to consider, but difficult to quantify, the socio-economic benefits associated with the expansion of an industry upon which a regional or local economy (and its resident employees) has been traditionally dependent. Some observers would also want to consider the "psychic" income associated with expanded employment opportunities in commercial fishing as a favored employment.

Revenue Flows to Hatchery Firms: Price and Productivity

The primary source of sales revenue for private hatchery firms will be from the sale of surplus adult salmon (in excess of brood stock requirements) harvested at, or in close proximity to, the hatchery site.[3] A secondary source of revenue will be from the sale of spawned-out carcasses for use in nonhuman consumption products.

One basic dimension of sales revenue determination is the biological productivity of a hatchery. Productivity determines the quantity of surplus fish (per million eggs) available for sale. This quantity and the other basic dimension of sales revenue determination, price, jointly determine the sales revenue of the hatchery firm.[4] The analysis of economic feasibility at the present early stage of development of Alaska's enhancement program can safely abstract from the price effects of increased supplies. Such abstraction is justified by the uncertainty associated with the eventual success of ocean ranching and by the negligible incremental impact of the early hatcheries on total production. Long-run price forecasts, not attempted in this report, will in some way have to account for the American, Canadian, Japanese, and Russian salmon enhancement programs and the uncertainties associated with their long-run impacts.

---

[3]The value of salmon eggs from the surplus fish will be treated in this report as a part of the value of the fish in round weight. This treatment is consistent with one of the several methods of price determination used in Prince William Sound. It may develop that hatcheries will eviscerate salmon prior to sale, selling eggs separately to enhance their price.

[4]A fact often misunderstood is that, if the Alaska and other salmon-enhancement programs eventually lead to very large percentage increases in supply of salmon and downward pressure on price, total revenue to hatchery and offshore harvesters *may either increase or decrease* depending upon the coefficient of the price elasticity of demand, or its reciprocal, the price-flexibility coefficient. That is, a *decrease in the price of salmon* due to the increased supplies from enhancement programs, *does not necessarily mean a fall in total revenue* to harvesters.

Table 1 contains a description of terms and notation used in the feasibility analyses presented in this report. On the assumption that spawned-out salmon have no market, the revenue of a hatchery (in level-one feasibility analysis where only sales revenue derived from surplus salmon is considered) for period t is given by:

$$R^*_t = S_t \cdot v_t \qquad (1) \text{ where}$$

$$S_t = P \cdot E_{t-g} \qquad (2) \text{ where}$$

$$P = efh - \frac{1+m}{n} \qquad (3)$$

Table 2 shows the derivation of survival rates, $e \cdot f$, for a pink salmon hatchery under alternative assumptions concerning egg-to-fry survival and fry-to-adult survival for unfed and fed fry. Table 3 combines these survival rates with alternative assumptions about the escapement rate of adult fish through the off-shore fishery to the hatchery, h, to arrive at productivity coefficients, $P = efh - \frac{1+m}{n}$. The term $\frac{1+m}{n}$ gives the brood-stock necessary for a given egg stock requirement, E. For example, a 25 million egg hatchery would require $S'_t = 20,833$ each period if the ratio of males to females required for fertilization is 1/3, m = 1/3, and there are 1600 eggs per female on the average, n = 1600; $S'_t = \frac{1 + 1/3}{1600} \cdot 25,000,000 = 20,750$. The brood stock requirement acts as a drain on productivity in the sense that it decreases the hatchery surplus of high-valued bright fish in year t; it is, of course, a necessary input into the productivity of the hatchery two years hence (t + 2).

Because there is a significant degree of uncertainty associated with estimates of survival rates and hatchery escapement rates, it is possible for critics to challenge any particular set of assumptions underlying a "P" value used in feasibility analysis. As the array of values for P shown in Table 3 makes clear, however, there is some

Table 1

Glossary of Notation

P	= "productivity coefficient" encompasses egg-to-fry survival, fry-to-adult survival, escapement to hatchery, and brood stock assumptions
e	= egg-to-fry survival rate
f	= fry-to-adult survival rate
h	= hatchery escapement rate
(1-h)	= common-property fishery escapement rate
m	= ratio of males to females used in fertilization
n	= average number of eggs per female
E	= hatchery egg stock
S	= hatchery surplus of bright salmon
S'	= brood-stock requirement
R*	= annual hatchery revenues from sale of surplus salmon
PVR*	= present value of hatchery revenues
R^F	= annual common-property fishery net revenues from sale of hatchery-originated salmon
PVR^F	= present value of net revenues to common-property fishing units
R^T	= total revenues to hatchery and common-property fishery from the sale of hatchery-originated salmon
PVR^T	= present value of total revenues
v	= price per fish
v*	= price per fish at which hatchery investment becomes economically feasible
C^I	= initial investment cost
C^O	= annual operating cost
PVC^O	= present value of annual operating cost
C	= total annual cost
PVC	= present value of cost
MC^F	= marginal cost incurred by common-property fishery from harvesting hatchery-originated salmon
NPV	= net present value
B/C	= benefit/cost ratio
N	= number of time periods
t	= time period
g	= number of years in life cycle of species of salmon being evaluated
H	= annual harvest by common property fishery
i	= interest rate or discount rate

TABLE 2

Derivation of Survival Rate (e · f)

	Fry-to-Adult Survival (f)					
	Unfed Fry			Fed Fry		
Egg-to-Fry Survival (e)	.01	.015	.02	.03	.04	.05
.70	.00700	.01050	.01400	.02100	.02800	.03500
.75	.00750	.01125	.01500	.02250	.03000	.03750
.80	.00800	.01200	.01600	.02400	.03200	.04000

TABLE 3

Derivation of Productivity Coefficients[1] ($P = e \cdot f \cdot h - \frac{1+m}{n}$)

Unfed Fry				Fed Fry			
Survival Rate (e·f)	Productivity Coefficient@			Survival Rate (e·f)	Productivity Coefficient @		
	h = 30%	h = 40%	h = 50%		h = 30%	h = 40%	h = 50%
.00700	.00127	.00197	.00267	.02100	.00547	.00757	.00967
.00750	.00142	.00217	.00292	.02250	.00592	.00817	.01042
.00800	.00157	.00237	.00317	.02400	.00637	.00877	.01117
.01050	.00232	.00337	.00442	.02800	.00757	.01037	.01317
.01125	.00255	.00367	.00480	.03000	.00817	.01117	.01417
.01200	.00277	.00397	.00517	.03200	.00877	.01197	.01517
.01400	.00337	.00477	.00617	.03500	.00967	.01317	.01667
.01500	.00367	.00517	.00667	.03750	.01042	.01417	.01792
.01600	.00397	.00557	.00717	.04000	.01117	.01517	.01917

[1]For pink salmon a conservative estimate of the brood stock requirement is given by:

$$\frac{1+m}{n} = \frac{1+1/3}{1600} = .00083\,333 \approx .00083$$ times the number of eggs required.

degree of central tendency in the value of P which makes possible the selection of a reasonable range of values for P. The central tendency derives from the fact that, for example, a relatively high assumed value of "e" combined with a low assumed value for "f" and a mid-range value for "h" will yield approximately the same P value as, say, a relatively low value for both "e" and "f" and a relatively high value of "h" (if e = .8, f = .01, and h = .4, P = (.8) (.01) (.4) - .00083 = .00237; and if e = .70, f = .01 and h = .45, P = (.7) (.01) (.45) - .00083 = .00232). Thus, while events may prove that an analyst's assumption with respect to fry survival is excessively optimistic (pessimistic), his assumption with respect to egg-to-fry survival and the hatchery escapement rate may have been excessively pessimistic (optimistic) resulting in an assumed productivity rate approximate to that actually realized; such trade-offs are more likely if central values of P are chosen for feasibility analysis.

Table 4 shows the revenue flows of a 25-million egg pink salmon hatchery over a range of prices and productivity rates. The productivity rates utilized for the feasibility analyses include a low range, mid range and high range for both the unfed and fed fry assumptions. Thus six alternative productivity rates are used and these span the range of "reasonable pessimism" to "reasonable optimism." "Cautious optimism" is achieved by relying on the mid-range productivity factors. The author shares the reader's probable amusement or aggravation, as the case may be, because it is generally accepted that the reasonableness of assumptions built into feasibility analyses can only be evaluated *ex post* in light of actual experience. The productivity rates do span the central tendency of present knowledge, however, and this seems to be as sound a basis as any for evaluating reasonableness of assumptions *ex ante*.

TABLE 4

Annual Revenues[1] (R*) for a Pink Salmon Hatchery
With a Twenty-Year Life
By Prices and Productivity Rates

Productivity[2] Coefficient	Annual[3] Surplus	Price Per Fish, v = ($)[4]							
		($0.95)	($1.14)	($1.33)	($1.52)	($1.71)	($1.90)	($2.09)	($2.28)
Unfed Fry									
.00127	31,750	$ 30,163	$36,195	$42,228	$48,260	$54,293	$60,325	$66,358	$72,390
.00367	91,750	87,163	104,595	122,028	139,460	156,893	174,325	191,758	209,190
.00717	179,250	170,288	204,345	238,403	272,460	306,518	340,575	374,633	408,690
Fed Fry									
.00547	136,750	$129,913	$155,895	$181,878	$ 207,860	$233,843	$259,825	$285,808	$311,790
.01117	279,250	265,288	318,345	371,403	424,460	477,518	530,575	583,633	636,690
.01917	479,250	455,288	546,345	637,403	728,460	819,518	910,575	1,001,633	1,092,690

[1]Rounded to nearest dollar.

[2]Brood stock requirement for years 21 and 22 is deducted in the same manner as for years 1-20 on the assumption that reinvestment will occur.

[3]For an assumed hatchery capacity of 25 million eggs; derived by multiplying 25 million by productivity coefficient.

[4]In the pink salmon life cycle (see Figure 2), year one begins in August-September with egg-take and fertilization, followed by a period of incubation lasting until April and fry release in May or June. Fish return at the end of year two, having spent year two maturing in the ocean. For example, eggs taken in August-September 1976 will produce fry by April 1977 and mature fish by August-September 1978. Thus year one is July 1976 through June 1977 and year two is July 1977 through June 1978. Year three begins with harvest/egg-take and would yield the first surplus and revenue to the hatchery. These revenue estimates abstract from the necessity that may characterize some hatchery sites of building an egg source internally from a small doner stock.

The price alternatives built into Table 4 are price per pink salmon assuming 3.8 pounds per fish, the long-term Prince William Sound average. The eight alternative prices shown center on the 1976 average price for pink salmon in Prince William Sound of between $.40 and $.45 per pound. Thus to choose for feasibility analysis purposes a price below $1.52-$1.71 range per fish is to assume that future real prices will be below the 1976 price, and vice versa. A reasonably conservative approach, given that real price has been increasing, would be to utilize the high estimate of $1.71 for 1976 as the basic real-price assumption for the feasibility analysis.

Table 5 presents the revenue flows shown in Table 4, discounted to present value, at several discount rates, i, for a 20-year assumed life of the hatchery investment.[5] Current-period (constant) prices over the 20-year period are utilized rather than inflation-adjusted prices because current-period costs will be used for the feasibility analyses. In addition, as mentioned above, real price forecasts are not made; rather a range of prices are provided from which can be selected the price upon which economic feasibility is judged. An important limiting factor in this feasibility analysis is the selection of a particular real price from this range which is then treated as constant for the life of the hatchery. This approach was adopted in recognition of the limitations associated with long range real-price forecasts in a rapidly changing economic environment.[6]

---

[5]Discounting to present value is necessary whenever a comparison is made between revenue flows and cost flows which are incurred at different rates through time. Conceptually, discounting to present value is the opposite of compounding to future value. For a thorough discussion of the discounting concept see Edward Shapiro, *Macroeconomic Analysis*, Third Edition, 1974, pp. 158-163.

[6]These limitations derive not only from the normal difficulties associated with forecasting the future on the basis of data which reflect economic relationships of past time periods, but also from an inadequate data base for measuring the movement of relevant variables over past time periods.

Table 5

Present Value of Hatchery Revenue (PVR*)[1]

Price/Fish @ 3.8 lb/Fish (for v/lb. = $.25-.60)	Productivity Coefficient					
	Unfed Fry @ P = ( )			Fed Fry @ P = ( )		
i = .08	(.00127)	(.00367)[2]	(.00717)	(.00547)	(.01117)[2]	(.01917)
v = $0.95	253,912	733,738	1,433,484	1,093,608	2,233,194	3,832,614
1.14	304,690	880,481	1,720,176	1,312,324	2,679,828	4,599,132
1.33	355,475	1,027,232	2,006,876	1,531,049	3,126,470	5,365,658
1.52	406,253	1,173,974	2,293,568	1,749,765	3,573,104	6,132,176
1.71	457,038	1,320,725	2,580,269	1,868,490	4,019,747	6,898,703
1.90	507,816	1,467,468	2,866,960	2,187,207	4,466,380	7,665,220
2.09	558,602	1,614,219	3,153,661	2,405,932	4,913,023	8,431,747
2.28	609,379	1,760,961	3,440,352	2,624,648	5,359,656	9,198,264
i = .10						
v = $0.95	212,227	613,279	1,198,146	914,068	1,866,566	3,203,406
1.14	254,668	735,930	1,437,771	1,096,877	2,239,875	3,844,083
1.33	297,116	858,589	1,677,404	1,279,694	2,613,192	4,484,768
1.52	339,557	981,241	1,917,029	1,462,503	2,986,501	5,125,145
1.71	382,006	1,103,899	2,156,661	1,645,319	3,359,817	5,766,129
1.90	424,447	1,226,551	2,396,286	1,828,129	3,733,126	6,406,806
2.09	466,895	1,349,209	2,635,918	2,010,945	4,106,442	7,047,490
2.28	509,336	1,471,861	2,875,543	2,193,754	4,479,751	7,688,167
i = .12						
v = $0.95	179,621	519,056	1,014,065	773,632	1,579,790	2,711,240
1.14	215,541	622,863	1,216,874	928,355	1,895,744	3,253,484
1.33	251,468	726,677	1,419,690	1,083,083	2,211,705	3,795,735
1.52	287,388	830,484	1,622,499	1,237,806	2,527,659	4,337,979
1.71	323,315	934,298	1,825,315	1,392,535	2,843,620	4,880,230
1.90	359,235	1,038,105	2,028,124	1,547,258	3,159,574	5,422,474
2.09	395,162	1,141,919	2,230,940	1,701,987	3,475,535	5,964,725
2.28	431,082	1,245,726	2,433,749	1,856,709	3,791,489	6,506,969

[1]Rounded to nearest dollar. Derived from:

$$PVR^* = \sum_{t=(1+g)}^{N} \left[\frac{R^*_t}{(1+i)^t}\right] = \sum_{t=3}^{22} \left[\frac{R^*_t}{(1+i)^t}\right] = \frac{R^*_3}{(1+i)^3} + \frac{R^*_4}{(1+i)^4} + \cdots + \frac{R^*_{22}}{(1+i)^{22}}$$

[2]These columns are the basis for the NPV calculations in Table 9.

Figure 2 is designed to orient the reader who is unfamiliar with the pink salmon life cycle with the several time dimensions that are pertinent to the analyses contained in this report. As shown, parts of three production cycles (and three calendar years) are included in the two-year pink-salmon life cycle. This explains the rationale for the time subscripts in the formula used to derive the values in Table 5 where July, 1976 is the beginning of the first time period (production year) t = 1. The present value of revenue is expressed mathematically as:

$$PVR^* = \sum_{t=(1+g)}^{N} \left[\frac{R^*_t}{(1+i)^t} \right] = \sum_{t=3}^{22} \left[\frac{R^*_t}{(1+i)^t} \right] = \frac{R^*_3}{(1+i)^3} + \frac{R^*_4}{(1+i)^4} + \cdots + \frac{R^*_{22}}{(1+i)^{22}} \qquad (4),$$

where PVR* is present value of revenue, R^*_t is revenue accruing to the hatchery in year t, i is the rate of discount, and g is the length of the life cycle of the species of salmon being evaluated.

Cost Flows of Hatchery Firms

Level-one feasibility analysis includes the opportunity cost of all resources used by the hatchery firm. As discussed in detail in Chapter 1, the cost data available for this study are imperfect in many respects and should only be interpreted as order-of-magnitude estimates. It is appropriate, therefore, to use the feasibility analyses based on these data for generalizing about the economic feasibility (or other policy questions) of private nonprofit salmon aquaculture only if the limitations of the cost data, and the difficulty these create for comparability, are kept in mind.

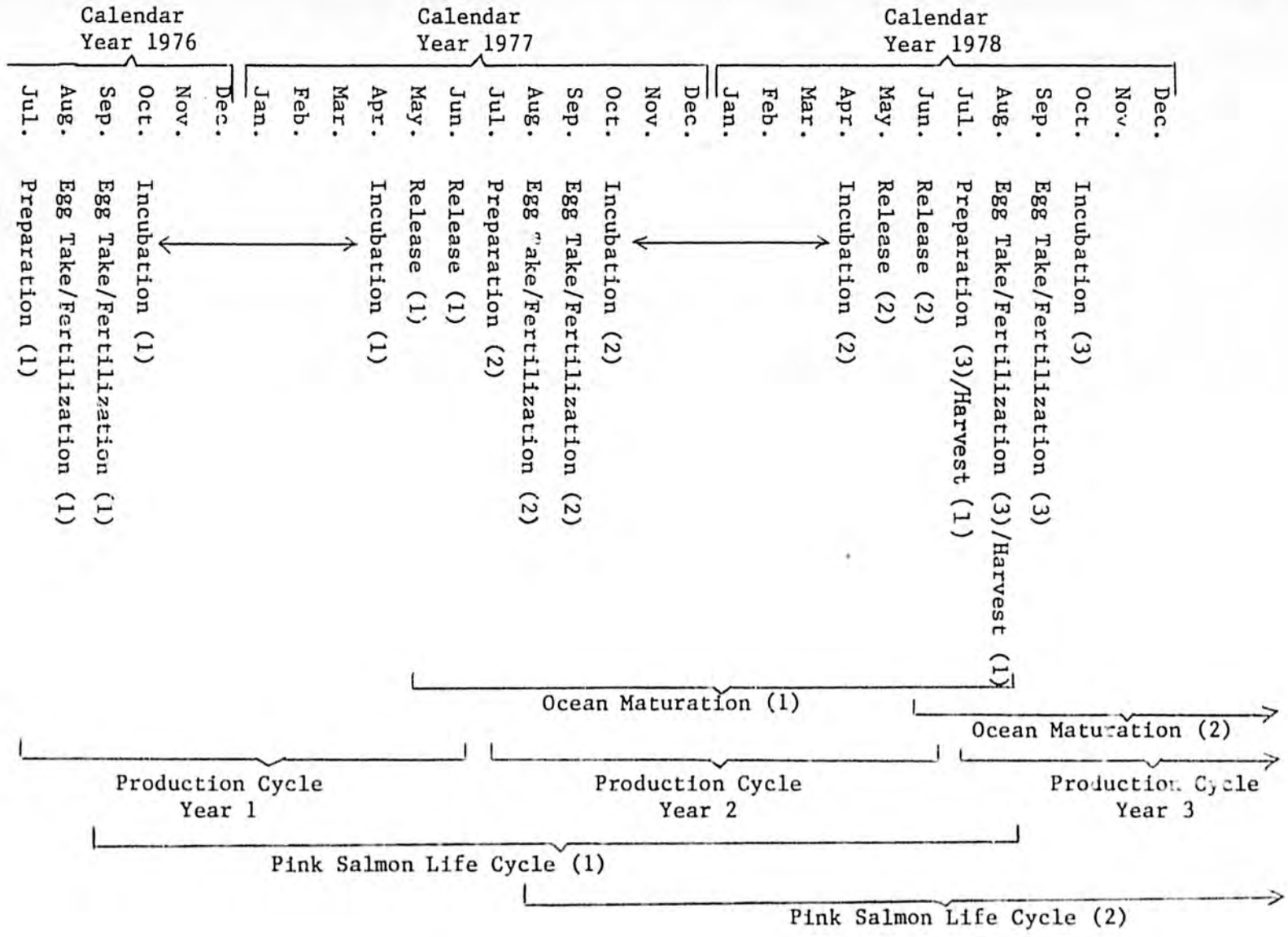


FIGURE 2: Production Cycles for Pink Salmon Hatchery

Note: Numbers in parentheses refer to the generation of salmon for production, ocean maturation, and life cycles, as indicated.

Construction Cost. Estimated construction costs are shown in Table 6. Included are all costs of materials and labor, project administration and general hatchery firm administration,[7] the estimated market value of donated services and materials used in construction (included in the miscellaneous category), the explicit interest cost on borrowed funds incurred over the construction period (January 1, 1975 - December 31, 1976), and the implicit interest cost on contributed capital over this period (included in the interest category). Contributed capital, including a $440,720 EDA grant, several smaller grants totalling $63,870, and fishermen-processor self assessments of $205,030 in 1975 and $220,060 in 1976, amounts to $929,680. The opportunity costs of contributed capital is treated as a cost even though the hatchery firm incurs no obligation to repay directly. To do otherwise would be to deny that: 1) these resources have alternative uses and 2) they were "contributed" with the expectation of receiving indirect benefits at least equal in value to the direct return these resources were capable of earning had they been employed elsewhere.

For the information of those readers who may be interested in greater detail, Appendix A, Table A-1, provides a description of each of the major cost categories shown in Table 6; Table A-2 describes, and lists the estimated value of, donated services and materials; and Table A-3 shows the calculation of implicit interest on contributed capital.

---

[7] Under most circumstances it would be expected that hatchery construction would be conducted on a contract basis with project administration costs incurred directly by the general contractor. In the case of the Port San Juan hatchery, P.W.S.A.C. incurred these costs directly because it was in effect the general contractor; hatchery firm general administration is only a minor part of the total costs shown in Table 6 as administration.

Table 6

Hatchery Construction Costs by Category

Category	Labor	Materials	Total to Nov. 1976	Est. % Completion	Est. Total at Completion
Water System	$106,894	$ 96,176	$ 203,070	85	$ 238,906
Incubation/Production System	54,098	113,638	167,736	90	186,373
Hatchery Building	115,523	55,574	171,097	95	180,102
Utility System Waste Treatment	33,324	17,887	51,211	98	52,256
Electrical Power Generation/Distribution	40,696	81,109	121,805	70	174,007
Miscellaneous	38,080	52,283	90,363	85	257,245[1]
Camp Cost	78,673	56,917	135,590	66	205,439
Engineering	52,131	-	52,131	90	57,923
Administration	192,436	135,905	328,341	-	511,499
General Administration	117,753	22,523	140,276	65	215,809[2]
Acquisition, Shipment & Distribution of Materials	74,683	90,806	165,489	80	206,861
Interest	-	22,576	22,576	85	88,829[3]
Undistributed Construction Costs[4]	9,205	96,013	105,218	70	150,311
TOTAL: Unfed Fry	$726,989	$694,070	$1,421,059[5]		$ 2,014,061
Fed Fry[6]	4,000	48,000			52,000
TOTAL: Fed Fry	730,989	742,070			2,066,061

[1]Includes estimated market value of donated services and materials of $150,936 (see Appendix Table A-2).

[2]Includes general hatchery firm administration during construction period.

[3]Includes estimated implicit interest on contributed capital of $62,222 (see Appendix Table A-3).

[4]Multiple-use construction items, e.g., concrete, plywood, nails, etc., that had not been allocated to specific categories, e.g., water system, by the time this report was written.

[5]This total becomes $1,630,723 when amounts in footnotes 1 and 3 to this table are included; the weighted average estimated percent completion is therefore 1,630,723/2,014,061 = 81%.

[6]Estimated costs of short-term fry holding and feeding facilities; to be constructed during 1977.

Operating Costs. Annual operating and maintenance cost estimates for the Port San Juan hatchery, including hatchery-firm administration, are based partially on experience with certain phases of the production cycle and partially on budget estimates. Consequently, there is considerable uncertainty about how representative of future experience these cost estimates are. Table 7 breaks out these costs by cost categories and functional phases of the production cycle. The opportunity cost of working capital is included; it is calculated at ten percent from the initial month of each period in the production year.

Table 8 shows annual operating costs C_t^o, over the 20-year life of the hatchery, discounted to present value for alternative assumed discount rates of 8, 10 and 12 percent. Shown separately is the cost of harvesting only, discounted to present value, for years 21 and 22. Note that estimated annual operating cost for the Port San Juan hatchery (from Table 7, rounded to the nearest one thousand) constitutes the mid-range estimate shown in Table 8 for years one through 20; the high-range and low-range are $\pm$ $75,000 of the mid-range estimate. For years 21 and 22, the mid-range estimate is $50,000, with $\pm$ $25,000 for the high and low-range estimates respectively. There are some bases for expecting that the estimated annual operating costs (the mid-range estimate) for a 25 million egg hatchery are higher than that which may be representative of other hatchery sites of comparable capacity and remoteness, and that for less remote sites the overstatement is considerable.(see pp. 3-5). Thus, the low and mid-range estimates are preferred for long-range feasibility analysis over the high-range estimate.

Table 7

Estimated Annual Operating and Maintenance Costs

	Cleaning and Repair (July)	Egg Take and Harvest (Aug-Sept)	Care and Incubation of Eggs (Oct-Apr)	Holding, Feeding and Release (May-June)	Total
Labor:	$ 5,621	$ 32,113	$ 38,442	$10,342	$ 86,518
Permanent	4,500	9,000	31,500	9,000	54,000
Temporary	1,121	23,113	6,942	1,342	32,518
Materials	4,000	8,951	5,360	37,850	56,161
Transportation and Freight	1,000	20,000	7,500	1,500	30,000
Administration	13,610	27,220	105,270	27,220	173,320
Lease	770	1,540	5,390	1,540	9,240
Utilities	115	230	805	230	1,380
Maintenance	100	200	700	200	1,200
Insurance	1,000	2,000	7,000	2,000	12,000
Permits/Licenses	25	50	175	50	300
Consulting Fees	3,000	6,000	30,000	6,000	45,000
Salaries	7,000	14,000	49,000	14,000	84,000
Office, Misc.	1,100	2,200	7,700	2,200	13,200
Travel	500	1,000	4,500	1,000	7,000
TOTAL	$24,231	$88,284	$156,572	$76,912	$345,999
Plus: Opportunity cost of operating & maintenance cost at 10% (from initial month)	2,423	8,093	11,743	1,282	23,541
TOTAL	$26,654	$96,377	$168,315	$78,194	$369,540

Table 8

Present Value of Estimated Hatchery Operating and Maintenance Costs[1]

	Low Range			Mid Range[2]			High Range		
Discount Rate	$295,000 Years 1-20	$25,000 Years 21-22	Total	$370,000 Years 1-20	$50,000 Years 21-22	Total	$445,000 Years 1-20	$75,000 Years 21-22	Total
i = .08	$ 2,896,310	$ 9,565	$2,905,875	$ 3,632,660	$ 19,130	$3,651,790	$ 4,369,010	$ 28,695	$4,397,705
i = .10	2,511,630	6,448	2,518,078	3,150,180	12,895	3,163,075	3,788,730	19,343	3,808,073
i = .12	2,203,355	4,380	2,207,735	2,763,530	8,760	2,772,290	3,323,705	13,140	3,336,845

[1]Derived from

$$PVC^{O} = \sum_{t=1}^{N}\left[\frac{C_t^{O}}{(1+i)^{t}}\right] + \sum_{t=(N+1)}^{(N+g)}\left[\frac{C_t^{O'}}{(1+i)^{t}}\right] = \frac{C_1^{O}}{(1+i)} + \frac{C_2^{O}}{(1+i)^{2}} + \cdots + \frac{C_{20}^{O}}{(1+i)^{20}} + \frac{C_{21}^{O'}}{(1+i)^{21}} + \frac{C_{22}^{O'}}{(1+i)^{22}}$$

, where C_t^{O} is annual operating costs for "normal" operating years of 1 through 20 and $C_t^{O'}$ is reduced annual operating cost for years 21 and 22; this amount is necessarily incurred to harvest returning fish of years 19 and 20 respectively and is estimated to be $50,000 (± 25,000) in each year.

[2]From Table 7, rounded to nearest one thousand.

Net Present Value and Level-One Feasibility

Having developed estimated ranges of revenues and costs for the Port San Juan hatchery, it is possible to evaluate level-one feasibility for private nonprofit hatchery firms by calculating the net present value corresponding to each set of assumptions about productivity, price, discount rate, and operating costs. Net present value is defined as the difference between the discounted present value of revenues earned from the sale of surplus salmon over the life of the investment minus capital costs and the discounted present value of annual operating and maintenance costs. This is shown in equation form as:

$$NPV = PVR^* - PVC \qquad (5)$$

, where NPV is net present value, PVR* is present value of revenue {as defined on p. 24, equation (4)} and PVC is present value of costs.

$$PVC = C^I + \sum_{t=1}^{N} \left[\frac{C_t^O}{(1+i)^t} \right] \qquad (6)$$

, where C^I is the initial investment (construction) cost incurred in t = 0, C_t^O is the operating and maintenance costs in year t. Substituting (4) and (6) into (5) we get:

$$NPV = \sum_{t=(1+g)}^{N} \left[\frac{R_t^*}{(1+i)^t} \right] - C^I - \sum_{t=1}^{N} \left[\frac{C_t^O}{(1+i)^t} \right] \qquad (7)$$

Assuming that the scrap value of the investment is zero in twenty years and given that the discount rate, i, reflects the competitive rate of return for investments of comparable risks, then a zero or positive NPV reveals that the hatchery investment is economically feasible. Table 9 shows the NPV at 1) discount rates of .08, .10 and .12, 2) alternative prices (v) from $0.95 to $2.28 per fish, 3) productivity coefficients (P)

Table 9

Net Present Value (NPV) of Port San Juan Hatchery: Level-One Feasibility[1]

	P = .00367[2]			P = .01117[3]		
Mid Range O & M Costs	i = .08	i = .10	i = .12	i = .08	i = .10	i = .12
v = $0.95	$-4,984	$-4,616	$-4,319	$-3,485	$-3,363	$-3,259
1.14	-4,837	-4,493	-4,215	-3,038	-2,989	-2,943
1.33	-4,691	-4,371	-4,112	-2,591	-2,616	-2,627
1.52	-4,544	-4,248	-4,008	-2,145	-2,243	-2,311
1.71	-4,397	-4,125	-3,904	-1,698	-1,869	-1,995
1.90	-4,250	-4,003	-3,800	-1,251	-1,496	-1,679
2.09	-4,104	-3,880	-3,696	- 805	-1,123	-1,363
2.28	-3,957	-3,757	-3,593	- 358	- 749	-1,047
v*	$ 7.40	$ 8.10	$ 8.86	$ 2.43	$ 2.66	$ 2.91
Low Range O & M Costs						
v = $0.95	$-4,238	$-3,971	$-3,755	$-2,739	$-2,718	$-2,694
1.14	-4,091	-3,848	-3,651	-2,292	-2,344	-2,378
1.33	-3,945	-3,726	-3,547	-1,845	-1,971	-2,062
1,52	-3,798	-3,603	-3,443	-1,399	-1,598	-1,746
1.71	-3,651	-3,480	-3,339	- 952	-1,224	-1,430
1.90	-3,504	-3,358	-3,236	- 506	- 851	-1,114
2.09	-3,358	-3,235	-3,132	- 58	- 478	- 798
2.28	-3,211	-3,112	-3,028	388	- 104	- 482
v*	$ 6.44	$ 7.10	$ 7.82	$ 2.11	$ 2.33	$ 2.57
High Range O & M Costs						
v = $0.95	$-5,730	$-5,261	$-4,884	$-4,231	$-4,008	$-3,823
1.14	-5,583	-5,138	-4,780	-3,784	-3,634	-3,507
1.33	-5,437	-5,016	-4,676	-3,337	-3,261	-3,191
1.52	-5,290	-4,893	-4,572	-2,891	-2,888	-2,875
1.71	-5,143	-4,770	-4,469	-2,444	-2,514	-2,559
1.90	-4,996	-4,648	-4,365	-1,997	-2,141	-2,243
2.09	-4,850	-4,525	-4,261	-1,551	-1,768	-1,927
2.28	-4,703	-4,402	-4,157	-1,104	-1,394	-1,611
v*	$ 8.37	$ 9.10	$ 9.89	$ 2.75	$ 2.99	$ 3.25

[1]In thousands of dollars.

[2]Assumes egg-to-fry survival rate of 75%, fry-to-adult survival rate of 1.5%, hatchery escapement rate of 40%, and brood stock requirement rate of .00083 (or 830 fish per one million eggs required--623 females and 207 males).

[3]Assumes egg-to-fry survival rate of 75%, fry-to-adult survival rate of 4%, hatchery escapement rate of 40%, and brood stock requirement of .00083.

of .00367 and .01117 (see Table 2 and Table 3 and footnote 2 to Table 5), and 4) the three ranges of estimated operating costs. Table 9 also gives v*, which is the approximate minimum price required for feasibility, for the productivity coefficient, discount rate, and operating and maintenance cost range shown in each column. Since R^*_t is $v_t \cdot S_t$ and $S = P \cdot E_{t-2}$, where E_{t-2} is the number of eggs incubated two years earlier, v* is obtained from the formula for NPV, equation (7), by setting NPV = 0 and by assuming that R*, and its components v and S, are the same in each year. The latter assumption is consistent with the treatment of revenue in Tables 4 and 5.

$$NPV = \sum_{t=(1+g)}^{N} \left[\frac{vS}{(1+i)^t} \right] - PVC \qquad (8)$$

$$O = v^*S \sum_{t=(1+g)}^{N} \left[\frac{1}{(1+i)^t} \right] - PVC \qquad (9)$$

$$v^* = \frac{PVC}{S \sum_{t=(1+g)}^{N} \left[\frac{1}{(1+i)^t} \right]} \qquad (10)$$

, where PVC can be obtained from Tables 6 and 8, S from Table 4 and $\sum_{t=(1+g)}^{N} \left[\frac{1}{(1+i)^t} \right]$ is the series present worth factor. For a discount rate of ten percent, the present value of the mid-range operating and maintenance cost is \$3,163,075 (Table 8), and the series present worth factor is 7.036. Given an annual surplus of 91,750 salmon (Table 4) and construction costs of \$2,066,061 (Table 6), a break-even price (v*) of v* = \$8.10 can be derived by substituting these values into equation (10).

$$v^* = \frac{5,229,136}{91,750 \times 7.036} = \frac{5,229,136}{645,533} = \$8.10$$

This formula can also be utilized to derive the productivity coefficient required for feasibility given price and cost conditions or, alternatively, to derive the cost level required for feasibility given price and productivity.

Figures 3 - 5, corresponding to Table 9, show net present value as a function of productivity, price and discount rate for the three ranges of estimated operating and maintenance costs. At a given discount rate it is possible to determine the effect of price on economic feasibility for each operating and maintenance cost range; alternatively it is possible to determine the effects on feasibility of variation in the discount rate at a particular price for each operating and maintenance cost range. Similarly, comparisons between Figures 3 - 5, for each combination of productivity, price and discount rate, reveal the effect of the operating and maintenance costs levels on feasibility. Compared to the other determinants of feasibility the productivity coefficient is conspicuous in its importance.

Table 9 summarizes the NPV approach to level-one feasibility analysis for the Port San Juan hatchery. It is apparent that level-one feasibility is not assured at any of the three discount rates for conservative assumptions about price, costs and productivity. An optimistic set of assumptions concerning price, ($v^* = \$2.11$), cost level (low range), and productivity ($P = .01117$) is required to attain level-one feasibility at an 8 percent discount rate.

The reader is cautioned that a failure to pass the level-one feasibility test is not necessarily a statement that private, nonprofit ocean ranching is economically unfeasible (see pp. 13 and 14); rather, it is a statement that sales revenues (from the sale of surplus fish) alone are not sufficient to cover all costs. This is not especially surprising inasmuch as 50-70 percent of the revenues generated from returning adult fish will normally accrue outside the hatchery firm.

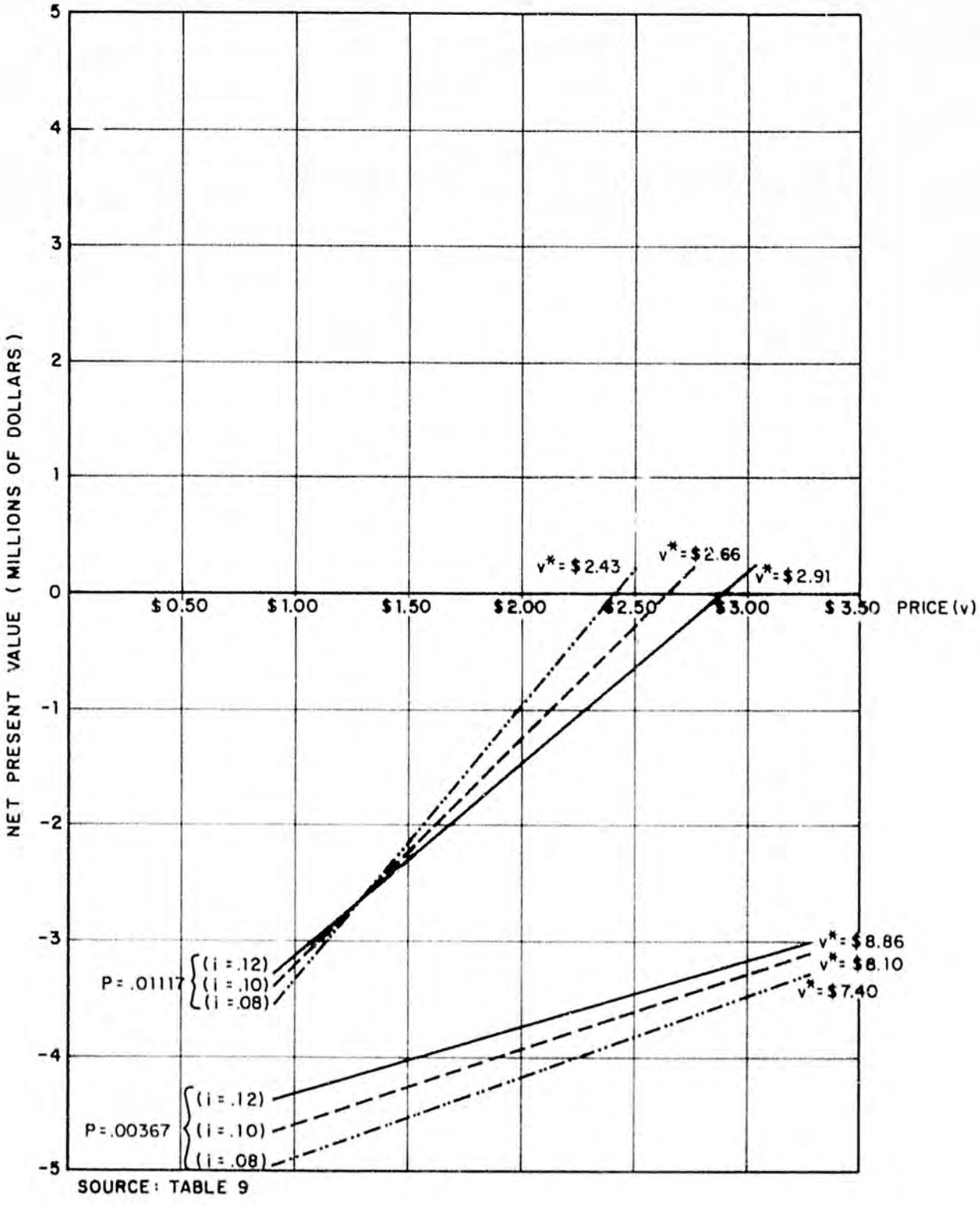
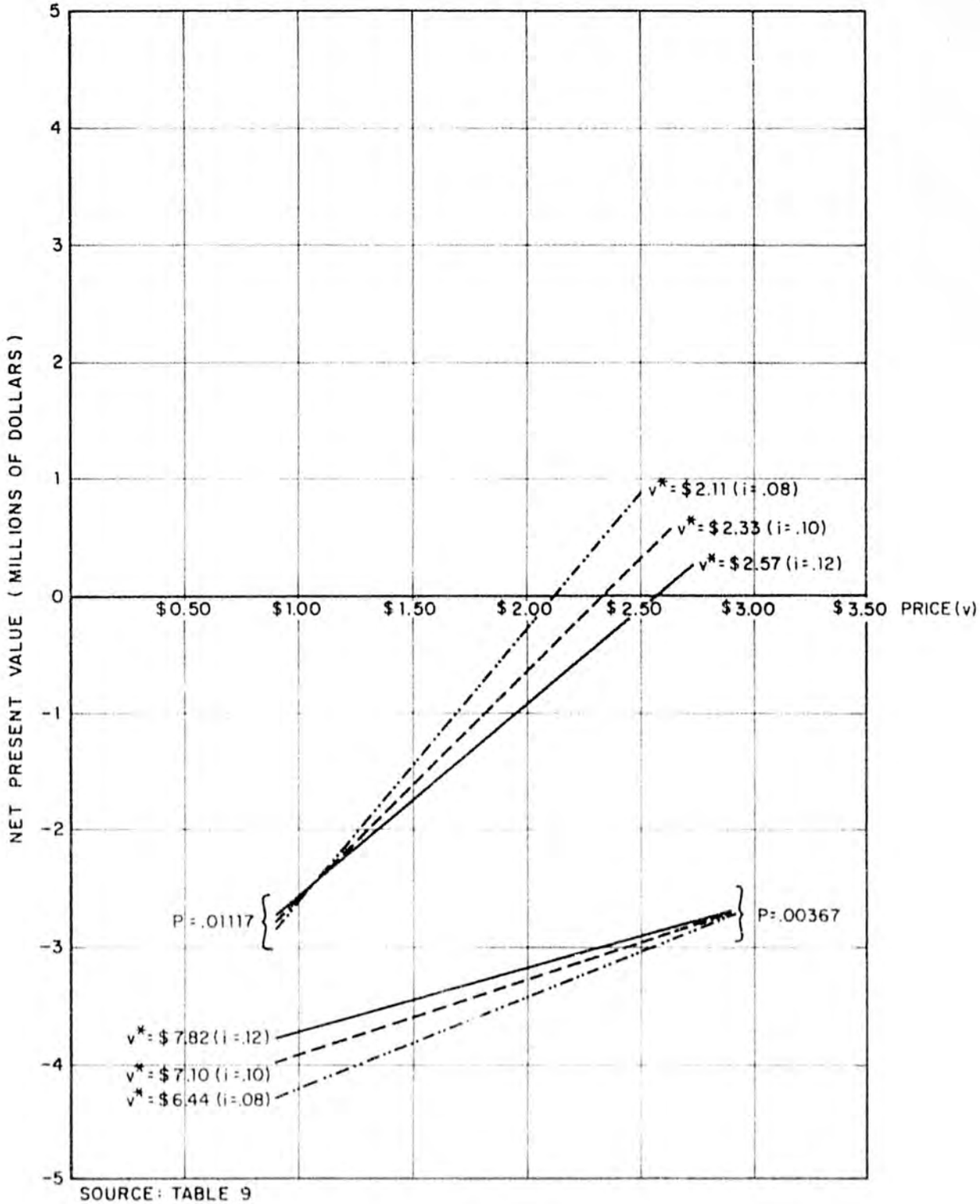


FIGURE 3

NET PRESENT VALUE AS A FUNCTION OF PRODUCTIVITY, PRICE, AND DISCOUNT RATE FOR MID-RANGE COST ESTIMATE



SOURCE: TABLE 9

FIGURE 4

NET PRESENT VALUE AS A FUNCTION OF PRODUCTIVITY, PRICE, AND DISCOUNT RATE FOR LOW-RANGE COST ESTIMATE

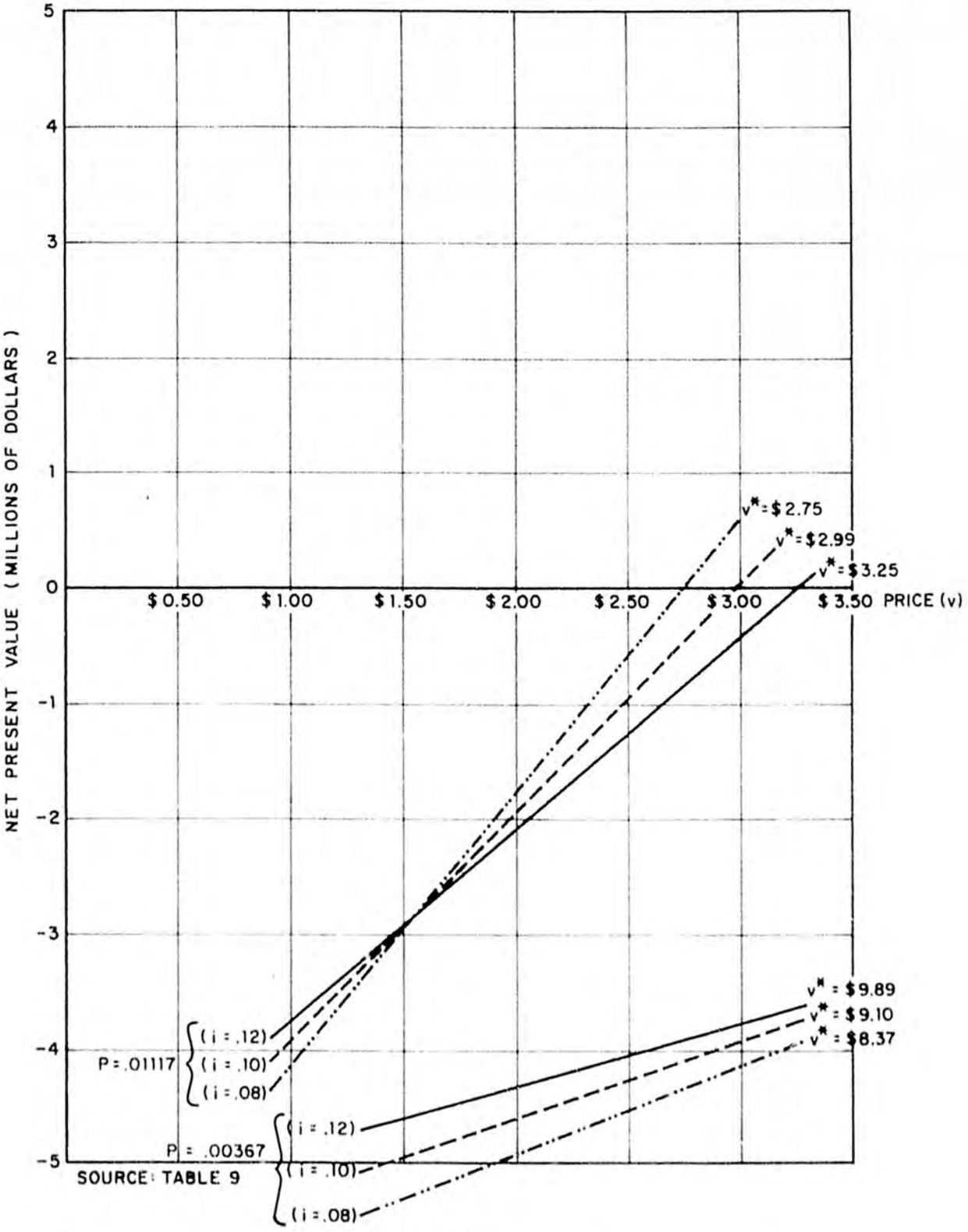


FIGURE 5

NET PRESENT VALUE AS A FUNCTION OF PRODUCTIVITY, PRICE, AND DISCOUNT RATE FOR HIGH-RANGE COST ESTIMATE

Unit Price and Cost Comparison and Level-One Feasibility

It is often helpful to compare costs and revenue in a short-run per-unit context as well as on a long-run, discounted-total basis. The former approach is shown in Table 10 where costs data from Tables 6 and 7 are allocated to fixed costs (costs that do not change with changes in the level of production) and variable costs (costs that are affected by changes in the level of production). The reader is cautioned against placing a high level of confidence in the allocations of the costs from Table 7 to the fixed and variable cost categories. There is always a degree of arbitrariness to such allocations, the degree of which increases when, as here, experience with a given production process is lacking. The format of Table 10 represents a useful breakdown of information for managerial decision making, however, and the design of an accounting information system by aquaculture firms should allow for meaningful allocations to this framework. An example of useful applications can be found in a study of Pacific oyster seed hatcheries (Im, Johnston and Langmo, 1976).

As can be seen in Table 10, a price per fish of \$6.67 when S = 91,750 (and \$2.19 when S = 279,250) is required to break even in each year. These prices are not strictly comparable to those derived from equation (10) for the otherwise comparable ten percent discount rate, .00367 and .01117 productivity coefficients, mid-range operating and maintenance cost cases (see v*, Table 9, middle columns under i = .10) because the latter takes into consideration the *timing* of receipts and expenditures. That is, the break-even price of \$6.67 in Table 10 implicitly assumes that R* of \$612,220 (=\$6.67 x 91,750) would be received in each of the first twenty years, whereas R* of zero will actually be received during the first two production years, and the full amount will be received in years 21 and 22. When allowing for the annual cost of the

Table 10

Estimated Annual Fixed and Variable Costs[1]

	Cleaning and Repair	Egg Take and Harvest	Care and Incubation of Eggs	Holding, Feeding, and Release	Total
Fixed Costs					
Capital Amortization @ 10%[2]	$ -	$ 44,124	$154,432	$ 44,124	$242,680
Lease	770	1,540	5,390	1,540	9,240
Maintenance	100	200	700	200	1,200
Insurance	1,000	2,000	7 0	2,000	12,000
Permits and Licenses	25	50	175	50	300
Utilities	115	230	805	230	1,380
Consulting Fees	3,000	6,000	30,000	6,000	45,000
Administrative Salaries	7,000	14,000	49,000	14,000	84,000
Travel	500	1,000	4,500	1,000	7,000
Office Expenses	1,100	2,200	7,700	2,200	13,200
Opportunity Cost of O&M Costs @ 10%	2,423	8,093	11,743	1,282	23,541
Total	16,033	79,437	271,445	72,626	439,541
Variable Costs					
Labor	5,621	32,113	38,442	10,342	86,518
Materials	4,000	8,951	5,360	37,850	56,161
Transportation and Freight	1,000	20,000	7,500	1,500	30,000
Total	10,621	61,064	51,302	49,692	172,679
Total Costs	26,654	140,501	322,747	122,318	612,220
Unit Costs (per 1000 fry)[3,4]					
Fixed Costs per Unit	.86	4.24	14.48	3.87	23.44
Variable Costs per Unit	.57	3.26	2.74	2.65	9.21
Total Costs per Unit	1.42	7.49	17.21	6.52	32.65
Unit Costs (per surplus salmon)[3]					
S = 91,750[5]					
Fixed Costs per Unit	.17	.87	2.96	.79	4.79
Variable Costs per Unit	.12	.67	.56	.54	1.88
Total Costs per Unit	.29	1.53	3.52	1.33	6.67
S = 279,250[6]					
Fixed Costs per Unit	.06	.28	.97	.26	1.57
Variable Costs per Unit	.04	.22	.18	.18	.62
Total Costs per Unit	.10	.50	1.16	.44	2.19

[1]Cost data taken from Table 7; capital amortization from Table 6.

[2]Allocated to the functional phases of the production year according to the proportion of the year occupied by each phase excluding the "Cleaning and Repair" phase. The data did not allow less arbitrary breakdown; however, the time distribution did appropriately allocate most of the capital costs to the phase "Care and Incubation of Eggs."

[3]Individual amounts may not add to totals due to rounding.

[4]At 75% survival 25,000 eggs gives 18,750 fry.

[5]At P = .00367, S = 91,750.

[6]At P = .01117, S = 279,250.

resultant working-capital requirements (see Table 15) the unit prices required to break even are $8.10 and $2.66 as in Table 9 and Figure 3.

Summary. Level-one feasibility analysis has been developed above to determine whether or not private nonprofit hatchery firms could survive without external support. The conclusion is that, as judged by the Port San Juan pink salmon hatchery, they cannot survive independently with present technology and price levels. It must be emphasized again, however, that in level-one feasibility analysis the revenues being compared to costs are only those that accrue to the hatchery firm from the sale of surplus salmon, or roughly 40 percent of the total revenues being created by the productive activity for which the costs are incurred. A more meaningful comparison of revenue and costs is the purpose of the level-two feasibility analysis which follows.

This is the appropriate place to make another point about level-one economic-feasibility analysis. Level-one analysis is an *economic analysis* structured so that the opportunity cost of all resources are included; it is not a *cash-flow analysis* structured to include only explicit cost, and designed to determined whether a hatchery firm can survive in the sense that it can pay all explicit costs through time. Cash-flow feasibility is possible for any investment, even economically infeasible ones, if the firm is sufficiently subsidized. Level-one economic-feasibility analysis seeks to determine whether subsidization is required, and level-two economic-feasibility analysis evaluates the economic justification for subsidy and attempts to identify the external beneficiaries who should pay the subsidies, if they are shown to be justified.

Level-Two Feasibility

The primary differences between level-one and level-two feasibility analysis derive from 1) an increase in the scope of the revenue side of the analysis, and 2)

an explicit recognition of the differential incidence of revenues and costs and the institutional implications of differential incidence.[8] The level-two feasibility test is the more flexible and appropriate tool for evaluating feasibility in a common-property environment.

The Definition of Revenues for Level-Two Feasibility Analysis

It will be recalled that for level-one feasibility analysis revenues were defined by equations (1) - (4):

$$R^*_t = S_t \cdot v_t \qquad (1), \text{ where}$$

$$S_t = P \cdot E_{t-g} \qquad (2), \text{ where}$$

$$P = efh - \frac{1+m}{n} \qquad (3), \text{ and}$$

$$PVR^* = \sum_{t=(1+g)}^{N} \frac{R^*_t}{(1+i)^t} \qquad (4).$$

Revenues must now be broadened to include those earned from the harvest and sale of hatchery-originated salmon by fishing units in the common-property fishery. Let the latter be represented by R^F where:

$$R^F_t = H_t \cdot v_t - MC^F_t \qquad (11), \text{ where H represents the harvest by the common-property fishery, } v_t \text{ is the price per fish as before, and } MC^F_t \text{ is the marginal cost of catching the hatchery-originated fish.}[9]$$

$$H_t = ef(1 - h)E_{t-g} \qquad (12), \text{ where all terms are as previously defined.}$$

---

[8] Incidence refers to the economic entities which have legal property rights in the case of revenues and legal liability in the case of costs. Differential incidence exists when the entity (ies) to which revenues accrue is (are) different, in whole or in part, from the entity (ies) to which the liability for payment of costs accrues.

[9] Marginal cost refers to the incremental or additional costs associated with harvesting hatchery-originated salmon; it excludes those harvesting costs which would have been incurred in the absence of hatchery-produced fish.

The total revenue, R_t^T, resulting from the productive activity of the hatchery is given by:

$$R_t^T = R^*_t + R_t^F \qquad (13).$$

The present value of revenue is similarly given by:

$$PVR^T = \sum_{t=(1+g)}^{N} \left[\frac{R_t^T}{(1+i)^t} \right] \qquad (14).$$

The marginal cost incurred by the common-property fishing units from harvesting hatchery-originated salmon, MC^F, can vary between zero and the total cost of a trip to fish a given location for a given number of days; it is more conveniently treated as a deduction from revenue than an increase in cost, as shown in equation (11). MC^F will be zero, or very close to zero, if hatchery fish are harvested incidental to trips and settings which would have occurred even in the absence of the hatchery run. In those cases where trips or settings (or part thereof) are the result of the presence of hatchery-originated salmon, MC^F will assume a significant positive value.

Discussions with fishermen from Prince William Sound reveal an expectation that Port San Juan hatchery salmon will be caught incidentally to trips and settings; or at most they will require settings that would not otherwise have occurred, but remain incidental to trips. Table 11 shows R_t^F for the returns attributable to the Port San Juan hatchery assuming levels of MC^F from \$.00 to \$.05 per fish and prices of \$0.95 to \$2.28 per fish. MC^F would, of course, be much higher if the harvest of hatchery-originated salmon requires trips that would not otherwise be taken. This is assumed not to be the case for the Port San Juan hatchery. Table 12 gives the discounted present value of the annual net revenues shown in Table 11 for MC^F = \$.02 and \$.05.

TABLE 11

Annual Net Revenues to Common-Property Fishing Units
From Port San Juan Originated Salmon[1]

Price/Fish @3.8 lb/Fish (for v/lb. = $.25 - .60)	MC^F = ( ) per Fish					
	($.00)	($.01)	($.02)	($.03)	($.04)	($.05)
H = 168,750[2]						
v = $0.95	$160,313	$158,625	$156,938	$155,250	$153,563	$151,875
1.14	192,375	190,688	189,000	187,313	185,625	183,938
1.33	224,438	222,750	221,063	219,375	217,688	216,000
1.52	256,500	254,813	253,125	251,438	249,750	248,063
1.71	288,563	286,875	285,188	283,500	281,813	280,125
1.90	320,625	318,938	317,250	315,563	313,875	312,188
2.09	352,688	351,000	349,313	347,625	345,938	344,250
2.28	384,750	383,063	381,375	379,688	378,000	376,313
H = 450,000[3]						
v = $0.95	$427,500	$423,000	$418,500	$414,000	$409,500	$405,000
1.14	513,000	508,500	504,000	499,500	495,000	490,500
1.33	598,500	594,000	589,500	585,000	580,500	576,000
1.52	684,000	679,500	675,000	670,500	666,000	661,500
1.71	769,500	765,000	760,500	756,000	751,500	747,000
1.90	855,000	850,500	846,000	841,500	837,000	832,500
2.09	940,500	936,000	931,500	927,000	922,500	918,000
2.28	1,026,000	1,021,500	1,017,000	1,012,500	1,008,000	1,003,500

---

[1]Derived from $R_t^F = H \cdot v_t - MC^F$

[2]Derived from $H = ef\ (1-h)E_{t-g}$, where e = .75, f = .015, (1-h) = .60 and E_{t-g} = 25 million.

[3]Derived from $H = ef\ (1-h)E_{t-g}$, where e = .75, f = .04, (1-h) = .60 and E_{t-g} = 25 million.

Table 12

Present Value of Net Revenues to Common-Property Fishing Units (PVR^F) [1]

Price/Fish @3.8 lb/Fish (for v/lb. = $.25 - .60)	MC^F = ( ) per Fish					
	i = .08		i = .10		i = .12	
	($.02)	($.05)	($.02)	($.05)	($.02)	($.05)
H = 168,750						
v = $0.95	$1,321,104	$1,278,484	$1,104,216	$1,068,593	$ 934,566	$ 904,416
1.14	1,591,002	1,548,390	1,329,804	1,294,188	1,125,495	1,095,351
1.33	1,860,908	1,818,288	1,555,399	1,519,776	1,316,430	1,286,280
1.52	2,130,806	2,088,194	1,780,988	1,745,371	1,507,359	1,477,215
1.71	2,400,713	2,358,092	2,006,583	1,970,960	1,698,295	1,668,144
1.90	2,670,611	2,627,999	2,232,171	2,196,555	1,889,224	1,859,080
2.09	2,940,517	2,897,897	2,457,766	2,422,143	2,080,159	2,050,009
2.28	3,210,415	3,167,803	2,683,355	2,647,738	2,271,088	2,240,944
H = 450,000						
v = $0.95	$3,522,933	$3,409,290	$2,944,566	$2,849,580	$2,492,168	$2,411,775
1.14	4,242,672	4,129,029	3,546,144	3,451,158	3,001,320	2,920,928
1.33	4,962,411	4,848,768	4,147,722	4,052,736	3,510,473	3,430,080
1.52	5,682,150	5,568,507	4,749,300	4,654,314	4,019,625	3,939,233
1.71	6,401,889	6,288,246	5,350,878	5,255,892	4,528,778	4,448,385
1.90	7,121,628	7,007,985	5,952,456	5,857,470	5,037,930	4,957,538
2.09	7,841,367	7,727,724	6,554,034	6,459,048	5,547,083	5,466,690
2.28	8,561,106	8,447,463	7,155,612	7,060,626	6,056,235	5,975,843

[1] Derived from $PVR^F = \sum_{t=(1+g)}^{N} \left[\frac{R_t^F}{(1+i)^t} \right] = \frac{R_3^F}{(1+i)^3} + \frac{R_4^F}{(1+i)^4} + \cdots + \frac{R_{22}^F}{(1+i)^{22}}$

Level-two feasibility analysis takes into account the revenues earned by the hatchery ($R^* = vS$) and those earned by fishing units in the common-property fishery ($R^F = vH - MC^F$). The sum of these revenue flows, discounted to present value, are given in Table 13.

The Definition of Costs for Level-Two Feasibility Analysis

Costs must be defined to include the opportunity cost of all resources employed by the hatchery firm for the production and recapture of surplus salmon, and by the common-property fishing units for the harvest of hatchery-originated salmon in the offshore fishery. The costs incurred by the hatchery firm that are to be included for the level-two feasibility test are identical to those used for the level-one analysis. Thus, Tables 6-8 provide the hatchery firm cost information needed for the evaluation of level-two feasibility. The other component of costs, the costs of harvesting hatchery-originated salmon incurred by the common property fishing units, has been treated as a deduction from revenue to arrive at net revenue, as discussed above and as shown in Table 11.

Net Present Value and Level-Two Feasibility

The information contained in Tables 6, 8, and 13 provides the basis for calculating net present value. Level-two feasibility exists when NPV ≥ 0. By expanding equation (7) we get:

$$NPV = \sum_{t=(1+g)}^{N} \left[\frac{R^*_t}{(1+i)^t}\right] + \sum_{t=(1+g)}^{N} \left[\frac{R^F_t}{(1+i)^t}\right] - C^I - \sum_{t=1}^{N} \left[\frac{C^o_t}{(1+i)^t}\right] \quad (15).$$

Table 14 contains net present value for $MC^F = \$.02$ at each of the three levels of

Table 13

Present Value of Total Revenues (PVR^T)[1]

Price/Fish @3.8 lb/Fish (for v/lb. = $.25 - .60)	Low-Productivity Case: S = 91,750 and H = 168,750			High-Productivity Case: S = 279,250 and H = 450,000		
	(i = .08)	(i = .10)	(i = .12)	(i = .08)	(i = .10)	(i = .12)
MC^F = $0.02						
v = $0.95	$ 2,054,842	$1,717,495	$1,453,622	$5,756,127	$4,811,132	$4,071,958
1.14	2,471,483	2,065,734	1,748,358	6,922,500	5,786,019	4,897,064
1.33	2,888,140	2,413,988	2,043,107	8,088,881	6,760,914	5,722,178
1.52	3,304,780	2,762,229	2,337,843	9,255,254	7,735,801	6,547,284
1.71	3,721,438	3,110,482	2,632,593	10,421,636	8,710,695	7,372,398
1.90	4,138,079	3,458,722	2,927,329	11,588,008	9,685,582	8,197,504
2.09	4,554,736	3,806,975	3,222,078	12,754,390	10,660,476	9,022,618
2.28	4,971,376	4,155,216	3,516,814	13,920,762	11,635,363	9,847,724
MC^F = $0.05						
v = $0.95	$2,012,222	$1,681,872	$1,423,472	$5,642,484	$4,716,146	$3,991,565
1.14	2,428,871	2,030,118	1,718,214	6,808,857	5,691,033	4,816,672
1.33	2,845,520	2,378,365	2,012,957	7,975,238	6,665,928	5,641,785
1.52	3,262,168	2,726,612	2,307,699	9,141,611	7,640,815	6,466,892
1.71	3,678,817	3,074,859	2,602,442	10,307,993	8,615,709	7,292,005
1.90	4,095,467	3,423,106	2,897,185	11,474,365	9,590,596	8,117,112
2.09	4,512,116	3,771,352	3,191,928	12,640,747	10,565,490	8,942,225
2.28	4,928,764	4,119,599	3,486,670	13,807,119	11,540,377	9,767,332

[1] $PVR^T = PVR^* + PVR^F$. PVR^* is given in Table 5 and PVR^F is given in Table 12.

Table 14

Net Present Value (NPV): Level-Two Feasibility at MC^F = \$0.02/Fish[1]

Price/Fish @3.8 lb/Fish (for v/lb. = \$.25 - .60)	Low-Productivity Case: S = 91,750 and H = 168,750			High-Productivity Case: S = 279,250 and H = 450,000		
	(i = .08)	(i = .10)	(i = .12)	(i = .08)	(i = .10)	(i = .12)
Mid Range O & M Costs						
v = \$0.95	\$-3,663,009	\$-3,511,641	\$-3,384,729	\$ 38,276	\$ -418,004	\$ -766,393
1.14	-3,246,368	-3,163,402	-3,089,993	1,204,649	556,883	58,713
1.33	-2,829,711	-2,815,148	-2,795,244	2,371,030	1,531,778	883,827
1.52	-2,413,071	-2,466,907	-2,500,508	3,537,403	2,506,665	1,708,933
1.71	-1,996,413	-2,118,654	-2,205,758	4,703,785	3,481,559	2,534,047
1.90	-1,579,772	-1,770,414	-1,911,022	5,870,157	4,456,446	3,359,153
2.09	-1,163,115	-1,422,161	-1,616,273	7,036,539	5,431,340	4,184,267
2.28	-746,475	-1,073,920	-1,321,537	8,202,911	6,406,227	5,009,373
v*	2.61	2.85	3.11	0.93	1.02	1.11
Low Range O & M Costs						
v = \$0.95	\$-2,917,094	\$-2,866,644	\$-2,820,174	\$ 784,191	\$ 226,993	\$ -201,838
1.14	-2,500,453	-2,518,405	-2,525,438	1,950,564	1,201,880	623,268
1.33	-2,083,796	-2,170,151	-2,230,689	3,116,945	2,176,775	1,448,382
1.52	-1,667,156	-1,821,910	-1,935,953	4,283,318	3,151,662	2,273,488
1.71	-1,250,498	-1,473,657	-1,641,203	5,449,700	4,126,556	3,098,602
1.90	-833,857	-1,125,417	-1,346,467	6,616,072	5,101,443	3,923,708
2.09	-417,200	-777,164	-1,051,718	7,782,154	6,076,337	4,748,822
2.28	-560	-428,923	-756,982	8,948,826	7,051,224	5,573,928
v*	2.27	2.50	2.76	0.81	0.89	0.98
High Range O & M Costs						
v = \$0.95	\$-4,408,924	\$-4,156,639	\$-3,949,284	\$ -707,639	\$-1,063,002	\$-1,330,948
1.14	-3,992,283	-3,808,400	-3,654,548	458,734	-88,115	-505,842
1.33	-3,575,626	-3,460,146	-3,359,799	1,625,115	886,780	319,272
1.52	-3,158,986	-3,111,905	-3,065,063	2,791,488	1,861,667	1,144,378
1.71	-2,742,328	-2,763,652	-2,770,313	3,957,870	2,836,561	1,969,492
1.90	-2,325,678	-2,415,412	-2,475,577	5,124,242	3,811,448	2,794,598
2.09	-1,909,030	-2,067,159	-2,180,828	6,290,624	4,786,342	3,619,712
2.28	-1,492,390	-1,718,918	-1,886,092	7,456,996	5,761,229	4,444,818
v*	2.95	3.20	3.48	1.05	1.14	1.24

[1]Derived from: $NPV = PVR^T - C^I - PVC^O$, where $PVR^T = PVR^* + PVR^F$. PVR^T is given in Table 13, C^I is given in Table 6, and PVC^O is given in Table 8.

operating and maintenance costs (Table 8); v*, the break-even price, is also given. Figures 6-8 show net present value as a function of productivity, price, and discount rate. A comparison of these with Figures 3-5 provides a direct comparison of level-one and level-two feasibility for the Port San Juan hatchery. For the "low-productivity case" considerable real price increase would be required, even with the low-range cost estimates, for level-two feasibility. For the "high-productivity case," level-two feasibility exists at almost all price, discount rate, and cost range combinations. Once again, the biological productivity of a hatchery stands out as the most crucial determinant of economic feasibility.

Net Present Value for the Moderate-Productivity Case

As discussed above (pp.17-20) the limits of the range of reasonable assumptions have been built into the low-productivity and high-productivity cases. However, Tables 2 and 3 are designed to allow choice among a large number of alternative combinations of assumptions. While this approach is intended to provide the reader with flexibility in choosing those assumptions (about survival rates, prices, cost levels, etc.) which appear to be most realistic, it has not brought out explicitly the implications for feasibility of what many observers would consider to be the most reasonable set of assumptions. The exercise which follows may be helpful to many readers in that it will start from the beginning and work through the feasibility analysis step by step. It is hoped that doing so will enhance the reader's ability to make use of the full range of information that is built into the tables for evaluating the effects on feasibility of changing assumptions. This will become an important exercise as new information, particularly about survival rates and hatchery costs, is acquired.

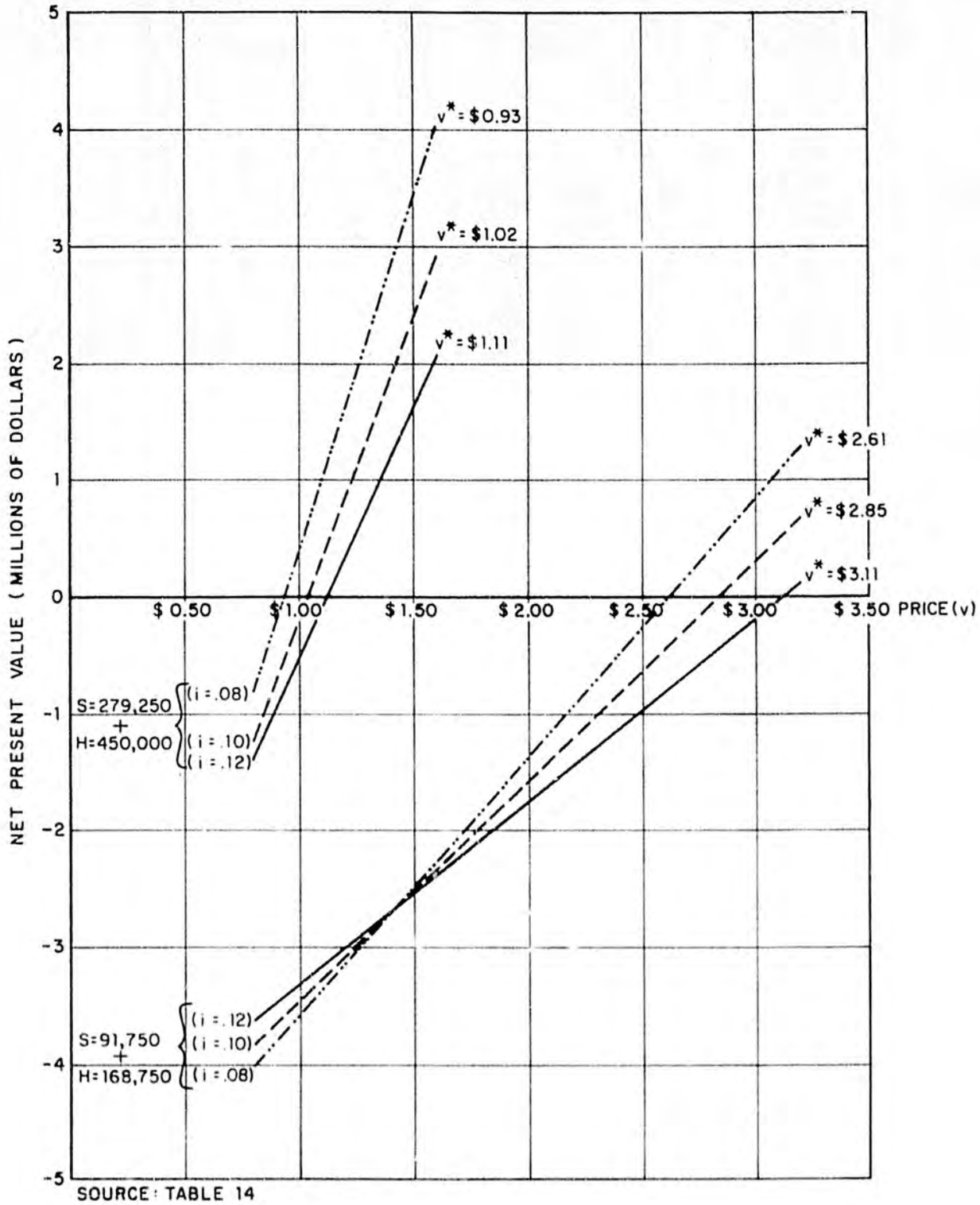


FIGURE 6

NET PRESENT VALUE AS A FUNCTION OF PRODUCTIVITY, PRICE, AND DISCOUNT RATE FOR MID-RANGE COST ESTIMATE

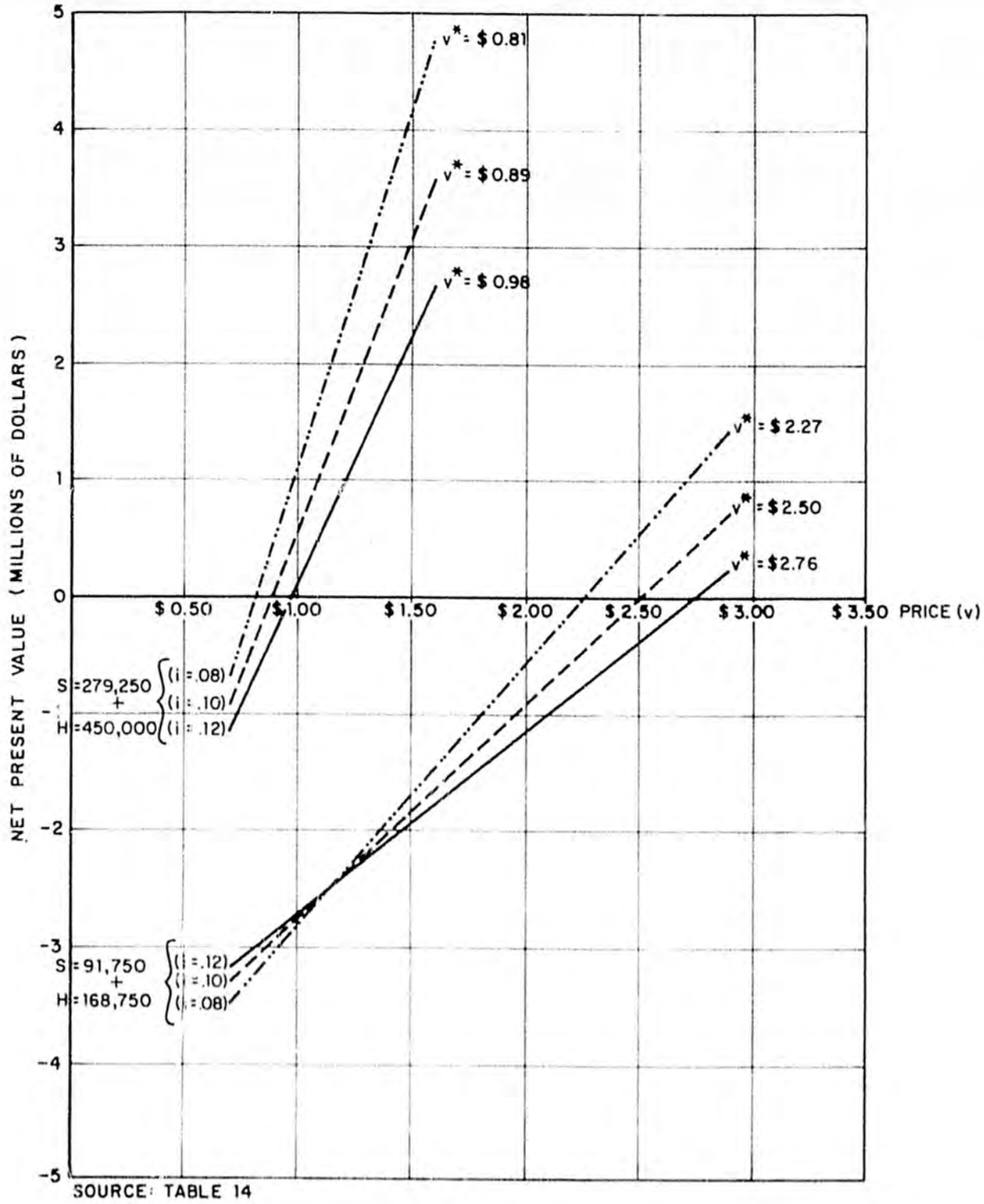


FIGURE 7

NET PRESENT VALUE AS A FUNCTION OF PRODUCTIVITY, PRICE, AND DISCOUNT RATE FOR LOW-RANGE COST ESTIMATE

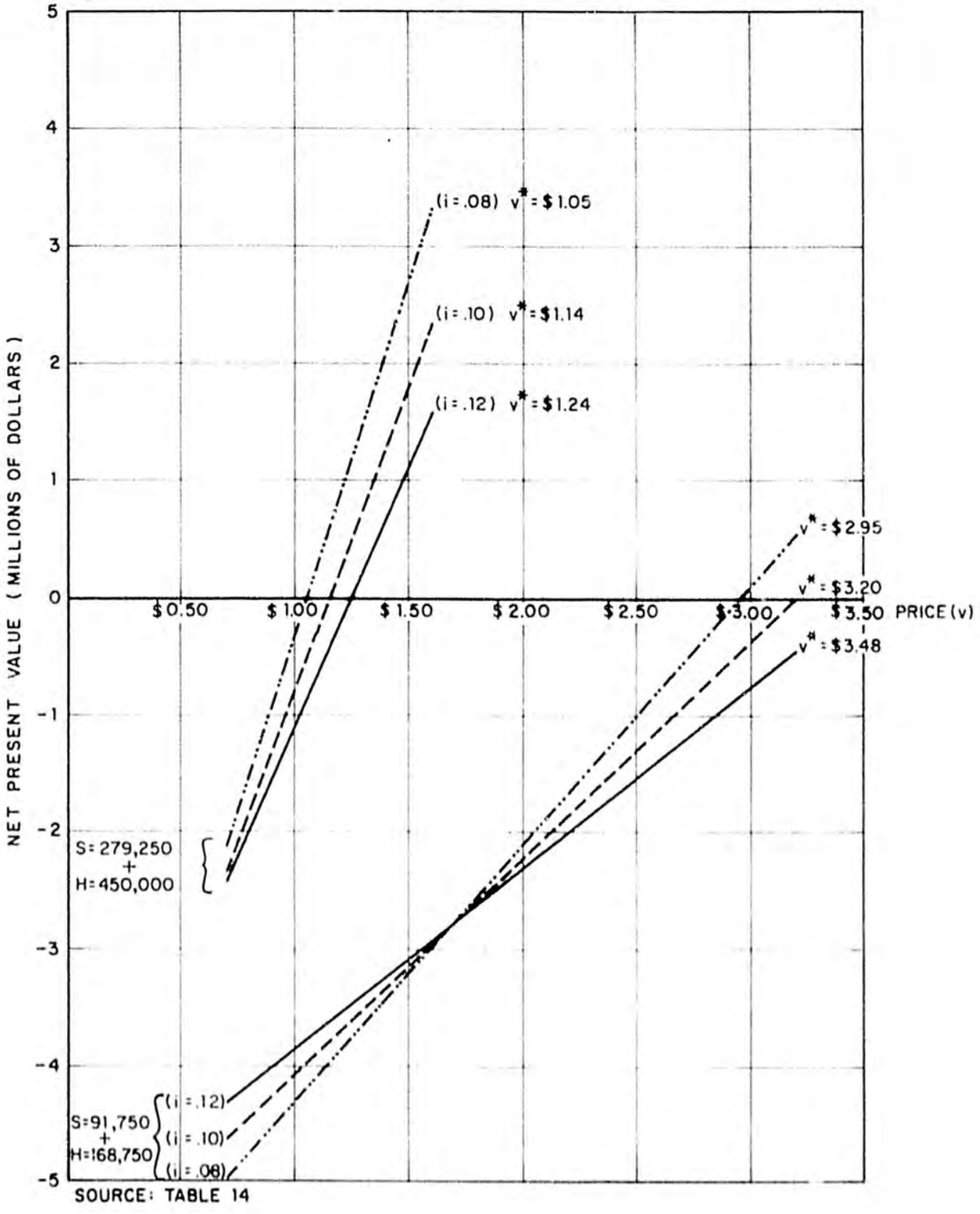


FIGURE 8

NET PRESENT VALUE AS A FUNCTION OF PRODUCTIVITY, PRICE, AND DISCOUNT RATE FOR HIGH-RANGE COST ESTIMATE

Table 15 contains the feasibility analysis for the moderate-productivity case. While each assumption is shown explicitly, several warrant explanation. First, with existing techniques the survival rate from egg to fry will probably typically fall between 80-90 percent (although it can be lower if the initial egg supply is collected a long distance from the hatchery under poor weather conditions); the assumed rate here will be 80 percent. This contrasts with the assumed rate of 75 percent used in both the low- and high-productivity cases. The fry-to-adult survival rate for fry which have undergone short-term rearing, and whose release is timed with favorable estuarine, temperature and nutrient conditions, will probably typically fall within the 2-4 percent range; 2.5 percent is utilized here. This contrasts with 1.5 percent for the low-productivity case and 4 percent for the high-productivity case evaluated above. As shown in Table 15, under these assumptions, 300,000 pink salmon are available for harvest by the common-property fishing units and 179,250 are available to the hatchery after allowing for brood stock requirements of 20,750 (15,563 females and 5,187 males) for a total hatchery-originated harvest of 479,250. At an assumed price of $1.71 per salmon, total revenues of $819,518 per year result for years 3-22; of this $513,000 (300,000 x 1.71) accrues to the offshore fishing units and $306,518 (179,250 x 1.71) to the hatchery.[10] The present values of these flows at a 10 percent rate of discount are $5,766,129, $3,609,468, and $2,156,661 respectively.

The costs incurred by the hatchery may be classified into three general categories: the cost of the initial investment $2,066,061 (from Table 6), the cost of operation and maintenance of $370,000 per year for years 1-20 and $50,000 per year

---

[10] This exercise abstracts from the nominal marginal cost of harvesting hatchery-originated salmon under the assumption that the harvest of these fish will be incidental to trips and settings which would otherwise have taken place.

Table 15

Economic Feasibility for Moderate-Productivity Case

Productivity

Beginning egg stock, pink salmon		25,000,000
Egg-to-fry survival @ 80%		20,000,000
Fry-to-adult survival @ 2.5%		500,000
Common-property harvest @ 60%		300,000
Hatchery escapement @ 40%	200,000	
Hatchery brood-stock requirements @ .00083[1]	20,750	
Hatchery surplus ($P = efh - \frac{1+m}{n} =$		
$.80 \times .025 \times .4 - .00083 = .00717 \times 25,000,000=$)		179,250
Total harvestable salmon		479,250

Level-Two Feasibility

Market value @ $1.71 per fish (total annual revenue)		$ 819,518
Present value of annual revenue	@ 8%	6,898,702
	@ 10%	5,766,129
	@ 12%	4,880,230
Present value of costs (mid range)[2]	@ 8%	$ 5,717,851
	@ 10%	5,229,136
	@ 12%	4,838,351
Net present value	@ 8%	$ 1,180,851
	@ 10%	536,993
	@ 12%	41,879

Conclusion: Hatchery investment feasible at level two for each rate of discount

---

[1] See Table 3.

[2] $2,066.061 + PVC^{O} = PVC$; see Tables 6 and 8.

(Continued on next page)

Table 15 (cont'd.)

Level-One Feasibility

Hatchery surplus		179,250
Market value @ $1.71 per fish (hatchery annual revenue)		$ 306,518
Present value of hatchery revenue	@ 8%	2,580,269
	@ 10%	2,156,661
	@ 12%	1,825,315
Present value of hatchery costs (mid range)[2]	@ 8%	$ 5,717,851
	@ 10%	5,229,136
	@ 12%	4,838,351
Net present value	@ 8%	$-3,137,582
	@ 10%	-3,072,475
	@ 12%	-3,013,036

Conclusion: Hatchery investment not feasible at level one

Level-One Feasibility with Assessment

Common-property fishery annual revenues (300,000 x $1.71)	$ 513,000
Present value of $513,000 @ 10% for 20 years (years 3-22)	3,609,468
Excess of present value hatchery costs over present value of hatchery revenues (see above under net present value @ 10%)	-3,072,475
Net present value to common-property fishery ($3,609,468 - 3,072,475)	536,993
Annual net revenue flow to common-property fishery[3]	76,321

---

[2] $2,066,061 + PVC^{O} = PVC; see Tables 6 and 8.

[3] Obtained by amortizing $536,993 @ 10% (years 3-22), or by subtracting annual assessments paid from annual revenue.

(Continued on next page)

Table 15 (cont'd.)

Summary

		Hatchery	Common-Property Fishery
Surplus harvest		179,250	300,000
Revenue @ $1.71/fish (years 3-22)		$306,518	$ 513,000
Annual costs (years 1-20)		743,197	-
Operating and maintenance[4]	$370,000		-
Investment amortized @ 10%[5]	242,680		-
Working capital @ 10%[6]	130,517		-
Revenue less annual costs		(436,679)	513,000
Annual assessments received (paid)[7]		436,679	(436,679)
Annual net revenue[3]		0	76,321

---

[3]Obtained by amortizing $536,993 @ 10% (years 3-22), or by subtracting annual assessments paid from annual revenue.

[4]See Table 7.

[5]Investment of $2,066,061 amortized @ 10% for 20 years.

[6]Amortization (@ 10% for years 3-22) of amount needed to finance annual working-capital requirements. See Appendix Table A-4.

[7]Paid in years 3-22; the present value of this stream of payments @ 10% is $3,072,475, which is the excess of PVC over PVR* experienced by the hatchery firm (level-one test).

for years 21 and 22 (from Tables 7 and 8), and the cost of working capital for years 1-2, financed by equal annual payments of $130,517 for years 3-22. The present value of these three categories of costs at a 10 percent rate of discount is $5,229,136.

Level-one feasibility is obtained when NPV ≥ 0, where NPV = PVR* - PVC, or where the benefit-cost ratio is equal to or exceeds one, B/C = PVR*/PVC ≥ 1. Note that for the level-one feasibility test, which is designed to determine whether the hatchery investment is feasible without external support, only the revenues earned by the hatchery firm from the sale of surplus salmon are included. That is, no grants or assessments of any kind are included in hatchery-firm revenues. The level-one test is the standard test for economic feasibility for a private-sector investment. It is not the most appropriate single test for judging the feasibility of private nonprofit salmon enhancement ventures, however because there are a significant amount of benefits (revenues) excluded from the test. The excluded revenues are, of course, those that accrue to the offshore fishery. What this test does show, however, is whether or not a private nonprofit hatchery firm is capable of covering all costs from its own sales revenues.

The information provided in Table 15 shows that at a discount rate of 10 percent level-one feasibility is not obtained. NPV is -3,072,475 ($2,156,661 - $5,229,136) or the benefit-cost ratio is $2,156,661/$5,229,136 = 0.41243. Nor is the investment feasible at either an 8 or 12 percent discount rate or even at any of the three discount rates combined with the low-range (rather than the mid-range) operating and maintenance cost assumption.

Level-two feasibility exists when NPV ≥ 0 or B/C ≥ 1, where NPV = PVR* + PVR^F - PVC and B/C = PVR* + PVR^F/PVC. As can be seen in Table 15, level-two

feasibility exists at the three discount rates since NPV 0 for each. At a discount rate of 10 percent NPV = $536,993 ($5,766,129 - $5,229,136) and B/C = $5,766,129/ $5,229,136 = 1.10269. In this case the present value of hatchery revenues, PVR*, is $2,156,661 as shown above and the present value of the offshore fishery revenues, PVR^F is $3,609,468. If the units in the offshore fishery agree to assess themselves (or arrange a comparable means of support) to cover the excess of hatchery costs over hatchery revenues of $3,072,475 (see above, NPV for level-one test at 10 percent), then NPV to the hatchery is zero (the investment becomes feasible) and NPV to the offshore fishery is $536,993 ($3,609,468 -$3,072,475). The required annual assessment (paid in years 3-22) would be $436,679; since annual revenues are $513,000 (300,000 salmon x $1.71) the net annual revenues are $76,321 ($513,000 - $436,679), the present value of which is $536,993 as above.

Tables 16 and 17 repeat the analysis of Table 15 for fry-to-adult survival rates of 2 and 3 percent respectively. It is apparent that level-two feasibility requires fry-to-adult survival of slightly greater than 2 percent, or a combination of egg-to-fry and fry-to-adult survival that will yield approximately 435,000 hatchery-originated salmon for sale.

Differential Incidence of Costs and Benefits

The significance of differential incidence is now clear. The hatchery firm assumes liability for the cost of enhancement (PVC = $5,229,136 at 10%) but receives less than 40 percent of the revenues (the 40 percent assumed escapement must also provide for brood stock). Under the values assumed in this moderate-productivity case NPV = -$3,072,475; the hatchery firm cannot survive without external support.

Table 16

Economic Feasibility for Low-Moderate Productivity Case

Productivity

Beginning egg stock,		25,000,000
Egg-to-fry survival @ 80%		20,000,000
Fry-to-adult survival @ 2.0%		400,000
Common-property harvest @ 60%		240,000
Hatchery escapement @ 40%	160,000	
Hatchery brood-stock requirements @ .00083[1]	20,750	
Hatchery surplus ($P = efh - \frac{1+m}{n} = .80 \times .02 \times .4 - .00083 = .00557 \times 25,000,000 =$)		139,250
Total harvestable salmon		379,250

Level-Two-Feasibility

Market value @ $1.71 per fish = total annual revenue		$ 648,518
Present value of annual revenue	@ 8%	5,459,225
	@ 10%	4,562,973
	@ 12%	3,861,925
Present value of costs (mid range)[2]	@ 8%	$5,717,851
	@ 10%	5,229,136
	@ 12%	4,838,351
Net present value	@ 8%	$- 258,626
	@ 10%	- 666,163
	@ 12%	- 976,426

Conclusion: Hatchery investment not feasible at level-two for each rate of discount. The hatchery investment should not be made because there is no level of assessment payments to the hatchery firm which would both 1) allow the hatchery firm to cover costs and 2) yield positive net benefits to the common-property fishery.[3]

---

[1] See Table 3.

[2] $2,066,061 + PVC^{O} = PVC; see Tables 6 and 8.

[3] Note that this conclusion is based on the mid-range operating cost and 1976 price-level assumptions. If the low-range operating cost estimate is utilized, the investment becomes feasible at an 8% discount rate but not at 10% or 12%.

Table 17

Economic Feasibility for High-Moderate Productivity Case

Productivity

Beginning egg stock		25,000,000
Egg-to-fry survival @ 80%		20,000,000
Fry-to-adult survival @ 3.0%		600,000
Common-property harvest @ 60%		360,000
Hatchery escapement @ 40%	240,000	
Hatchery brood-stock requirements @ .00083[1]	20,750	
Hatchery surplus ($P = efh - \frac{1+m}{n} = .80 \times .03 \times .4 -$ .00083 = .00877 x 25,000,000 =)		219,250
Total harvestable salmon		579,250

Level-Two Feasibility

Market value @ $1.71 per fish = total annual revenue		$ 990,518
Present value of annual revenue	@ 8%	8,338,181
	@ 10%	6,969,285
	@ 12%	5,898,535
Present value of costs (mid range)[2]	@ 8%	$5,717,851
	@ 10%	5,229,136
	@ 12%	4,838,351
Net present value	@ 8%	$2,620,330
	@ 10%	1,740,149
	@ 12%	1,060,184

Conclusion: Hatchery investment feasible at level-two for each rate of discount.

---

[1] See Table 3.

[2] $2,066,061 + PVC^{O} = PVC; see Tables 6 and 8.

(Continued on next page)

Table 17 (cont'd.)

Level-One Feasibility

Hatchery surplus		219,250
Market value @ $1.71 per fish (annual revenue)		$ 374,918
Present value of hatchery revenue	@ 8%	3,156,060
	@ 10%	2,637,923
	@ 12%	2,232,637
Present value of hatchery costs[2]	@ 8%	$5,717,851
	@ 10%	5,229,136
	@ 12%	4,838,351
Net present value	@ 8%	-2,561,791
	@ 10%	-2,591,213
	@ 12%	-2,605,714

Conclusion: Hatchery investment not feasible at level one.

Level-One Feasibility With Assessment

Common-property fishery annual revenues (360,000 x $1.71)	$ 615,600
Present value of $615,600 @ 10% for 20 years (years 3-22)	4,331,362
Excess present value hatchery costs over present value of hatchery revenues (see above under net present value @ 10%)	-2,591,213
Net present value to common property fishery (4,331,362 - 2,591,213)	1,740,149
Annual net revenue flow to common-property fishery[3]	247,327

---

[2] $2,066,061 + PVC^{0} = PVC; see Tables 6 and 8.

[3] Obtained by amortizing $1,740,149 @ 10% (years 3-22) or by subtracting annual assessments paid from annual revenue.

(Continued on next page)

Table 17 (cont'd.)

Summary

		Hatchery	Common-Property Fishery
Surplus harvest		219,250	360,000
Revenue @ $1.71/fish (years 3-22)		$347,918	$ 615,600
Annual costs (years 1-20)		743,197	-
Operating & maintenance[4]	$370,000		-
Investment amortized @ 10%[5]	242,680		-
Working capital @ 10%[6]	130,517		-
Revenue less annual costs		(368,273)	615,600
Annual assessments received (paid)[7]		368,273	(368,273)
Annual net revenue[3]		0	247,327

---

[3]Obtained by amortizing $1,740,149 @ 10% (years 3-22) or by subtracting annual assessments paid from annual revenue.

[4]See Table 7.

[5]Investment of $2,066,061 amortized @ 10% for 20 years.

[6]Amortization (@ 10% for years 3-22) of amount needed to finance annual working-capital requirements.

[7]Paid in years 3-22; the present value of this stream of payments @ 10% is $2,591,213 which is the excess of PVC over PVR* experienced by the hatchery firm (level-one test).

One apparent source of external support is from the common-property fishing units. Even with assessment payments of $3,072,475 (in present value) the offshore fishery would receive net benefits of $536,993 (in present value). This amount would be in addition to a 10 percent return on any part of the initial investment that has been financed by contributed capital from fishermen's assessments, because a 10 percent rate of return on capital is built into the hatchery's costs.[11] Of course, the greater the proportion of the initial investment financed by contributed capital from fishermen the smaller the annual assessment payments required of fishermen and the higher their *retained* net benefits.[12] Total net benefits to fishermen would be independent of the proportion of the initial investment financed by fishermen's contributed capital, however, because a fishermen's investment has an opportunity cost, assumed here to be 10 percent, just as does that of a financial institution. If fishermen can earn 10 percent in alternative investments as assumed, then the decision to invest in the hatchery is one which affects the *source* of fishermen's total income (that from fishing and other sources) but not the *amount*, assuming that other sources of financing for the hatchery can be found. If either the preceding assumption is invalid, or the rate of return on an investment in hatcheries exceeds that which can be earned in other investments of equal risks (the first of which is likely, and the second of which is

---

[11] In Table 15 capital costs are amortized at ten percent for years 1-20.

[12] Interest on contributed capital is an implicit cost which requires no explicit payments by the hatchery firm. The present application of the implicit cost concept may be unique in that in the absence of an obligation to explicitly pay interest the assessments required for hatchery-firm survival are reduced in equal amount and the retained revenue of offshore fishing units would be higher by that amount. That is, the hatchery firm not incurring an obligation to pay certain costs allows an equal retention of revenues by the offshore fishery. In practical terms this means that there is a need to depreciate contributed capital instead of amortizing at some positive interest rate as is required for borrowed or equity capital.

uncertain), then hatchery investments are preferable because the amount as well as the source of income is affected.

Given any combination of either the moderate- or high-productivity cases and either the mid- or low-range of operating and maintenance costs, hatchery investments are economically feasible at level two but not at level one. As demonstrated by the moderate-productivity case described in Table 15, however, hatchery investments failing the level-one test can survive if outside support is provided, and the latter is economically justified by the passage of the level-two feasibility test. What, then, stands in the way of the successful creation and maintenance of private nonprofit hatchery firms? The answer was suggested by the analysis of economic incentives in Chapter 1: The primary barriers to private sector salmon enhancement are the free-rider problem and extreme uncertainty. Thus, while level-two feasibility justifies and is a necessary condition for private nonprofit hatcheries to exist, it alone may not be sufficient to overcome the effect on economic incentives of these barriers. The next chapter evaluates the role of government in affecting economic incentives facing private nonprofit firms and considers other possible governmental responses to economically feasible salmon enhancement potential.

CHAPTER III

PUBLIC POLICY TOWARD PRIVATE SALMON ENHANCEMENT

Introduction

As discussed in Chapter I, the State of Alaska has cast itself in an active role in the area of salmon enhancement. An important and evolving dimension of the state's policy is to encourage some private sector investment in hatcheries. The economic feasibility of private nonprofit salmon hatcheries has been evaluated above without explicit recognition of the potential role of the state. What is clear from that evaluation is that the degree to which the state encourages the private sector will be an important determinant of the level of private-sector investment in enhancement facilities. This fact raises a number of questions: Is public-sector investment in hatcheries economically justified? If so, what insitutional options are open to the state for channeling funds into investments in salmon hatcheries? What are the comparative costs to the state of these options? Can the options be ranked on efficiency grounds? Can they be ranked on equity grounds? It is the purpose of this chapter to develop tentative answers to these questions.

Economic Justification for Public-Sector Investments

The basic economic criterion by which it is appropriate to judge the desirability of public-sector expenditures on investment projects is that the benefit-cost ratio be equal to or exceed one. As used here, benefit-cost analysis is equivalent to

level-three feasibility analysis (see p. 15); that is, it includes all significant categories of benefits and costs.

Given that level-two feasibility is established for the moderate-productivity case (see Table 15) it is very probable that level-three feasibility, the broad benefit-cost criterion, is satisfied. This assertion is based on the fact that benefits are more likely to be affected significantly by moving to the broader framework than are costs. Additional benefits are 1) those derived by the processing sector from improving capital utilization and therefore profitability, 2) those net benefits derived by the local economy from greater income-expenditure flows, and 3) those derived by the local and state governments from greater tax revenues. On the cost side, the only significant categories of extra cost, commensurate with the broader scope of the analysis, are those incurred by the state for management of hatchery stocks, and for providing technical assistance to private nonprofit firms.[1] Incrementally, these costs are likely to be quite small.[2] Therefore, a tentative conclusion, based on the existence of level-two feasibility and based on the above statements concerning the relative increases in benefits and costs associated with moving to a broader analytical framework is that public-sector investment is economically justified.

Given that public investment appears to be justified on the basis of a comparison of benefits and costs, does it necessarily follow that the public sector should in-

---

[1] For state hatcheries the comparable cost of technical assistance should be charged as a direct cost of the hatchery unit.

[2] It is not possible to assess the negative impacts on the wild stocks of hatchery stocks competing for food and space in the ocean environment.

vest independent of other rationale? The answer in general is negative because, in general, where benefits exceed costs the private sector will recognize sufficient profitability and the investment would become the domain of private enterprise. In the specific instance of salmon enhancement in Alaska, however, there are three reasons for believing that public investment is necessary. First among these is a political constraint which may be summarized as follows: The majority of Alaska residents appear to have a long-standing dislike for any arrangements resulting in processor control over harvesting units in the salmon fishery. This attitude apparently derives from pre-statehood Federal management of the salmon resources and in particular from the use of traps. It is widely believed among fishermen, a group that is very active politically, that legalizing private profit-seeking enhancement ventures would quickly lead to processor domination of hatchery investments; and it is further believed that processor investments in hatcheries would have a negative impact on the marketing position of fishermen. It is also likely that in areas where an established offshore fishery exists intense conflict would surround management decisions (the determination of appropriate escapement levels) if processors did indeed own the hatcheries. It is unlikely that management biologists could function effectively in such conflict situations. Given these problems, or anticipated problems, the Alaska Legislature opted for private *nonprofit* hatchery firms on the apparent expectation that groups of fishermen and small-scale entrepreneurs would be attracted, the latter responding to the opportunity for full-time employment in a remote area.[3] There apparently was no explicit consideration given to the adequacy

[3] A profit-seeking entrepreneur can be attracted to an investment in a "nonprofit" firm if the sum of the payments for his (her) labor services and the psychic income derived from enjoyable employment exceed the sum of these payments and implicit interest on "contributed capital" in alternative employments. The excess is "economic rent" or "economic profit."

of economic incentives or to the economic viability of either type of nonprofit firm.

The second reason why state investment will be necessary, given that the basic economic justification exists (B > C), is that among fishermen, the primary beneficiaries of hatcheries investments, there is a very substantial free-rider problem. The reasons for this have been discussed above (pp. 6-9); it should suffice here merely to point out that with a significant free-rider problem there is no assurance that even with level-two feasibility the self interest of fishermen will be sufficiently aroused to put together and finance a salmon hatchery firm. Thus, investments by the state, in the form of incentive subsidies to nonprofit firms, may be necessary to overcome the disincentive effects of the free-rider problem.

Third, for reasons that are biological, technological and economic (see pp. 9-11). there is considerable uncertainty on the part of fishermen about the returns that will be associated with potential hatchery investments. There are two areas of policy action by the state that have contributed to the otherwise great uncertainty. One of these derives from the reluctance of the Alaska Department of Fish and Game to establish interim escapement targets which would assist potential investors in determining expected revenue flows. Second, the state is emphasizing that both public hatcheries and private hatcheries have a place in the enhancement program without clearly assigning roles to either. The financial responsibility assumed by fishermen is much more explicit and immediate for private nonprofit hatchery than for a state hatchery and this creates an incentive to wait for a state hatchery, i.e., not support an effort to develop a nonprofit firm. This is true even though the apparent political reality is that the state will pay for its hatchery program by in-

creasing fish taxation. The proponents of a dual hatchery program are not emphasizing this point at present.

To summarize, public sector (state) investment in hatcheries, public or private, can be justified on the following grounds: 1) that benefits exceed costs (this is the fundamental economic justification), 2) that, for political-economic reasons, private profit-seeking hatchery firms have been disallowed by state law and 3) that there are significant economic disincentives, created by free-rider problems and uncertainty, to private-sector investments in hatcheries through nonprofit firms. Given these justifications for state support of an enhancement program, the institutional options open to the state for investing in hatcheries and the ranking of these on efficiency and equity grounds remain to be addressed.

Institutional Options Under Present Statutes

Ideally, there are a wide range of options with respect to the institutional forms for salmon enhancement from which policy makers can choose, ranging from private profit-seeking ventures of any size that can survive, to restricted-stock firms or cooperatives, to nonprofit firms, to state owned and operated hatcheries. The range of practical choice has been narrowed considerably by legislation to choosing among three forms--nonprofit hatchery firms which broadly represent beneficiaries in a region, these are often referred to as regional nonprofit associations; "nonprofit" hatchery firms which represent an entrepreneur or small group of entrepreneures; and state owned and operated hatcheries. The desirability of modifying legislation to increase the range of choice is discussed in the next section.

There are several problems one encounters in attempting to evaluate the relative merits of the primary alternative forms--regional nonprofit hatchery firms and state hatcheries.[4] One is the need to distinguish between hatcheries intended primarily for production purposes and those which can be classified as primarily research and development hatcheries. And for production hatcheries it is necessary to distinguish between exempt and nonexempt species (areas). The former are those for which private-sector development of production hatcheries must be delayed until certain bio-technical problems are overcome, the latter are those which can be readily developed by either sector. There is also the question of whether hatcheries on the rivers of interior Alaska are economically feasible and whether special institutional and equity considerations obtain to these situations. This would appear to be the case given that there is a domination by subsistence fisheries along the lengths of the major rivers, although commercial fisheries do exist.

The preceding suggests that it might be appropriate for the state to divide enhancement efforts between state hatcheries and regional, private nonprofit hatcheries according to function and specific circumstances. Under those circumstances where it would appear improbable that private-sector investment would be forthcoming (purely research hatcheries, species or areas where enhancement may be accompanied by serious bio-technical problems, and interior hatcheries) a public-sector investment should be made assuming that economic feasibility of the specific site has been es-

---

[4]The small private nonprofit hatchery firm, organized for the personal gain of one or several entrepreneures, will not be significant in the near term due to the obvious difficulties of obtaining venture capital for nonprofit firm. Over the long term, these firms may be the source of significant technical advances.

tablished.[5] *For all other circumstances, production hatcheries should be built and operated by private nonprofit firms.*

This suggested division of responsibilities between state and private nonprofit hatcheries is based on the premise that there are in total more economically feasible demands on state funds than can be financed and that private-sector investment in hatcheries is preferred where it can be induced with a lesser commitment of public funds than would be required for an equivalent state hatchery. The preference for the private sector, implicit in this approach, is based on three considerations. First is the principle that the attainment of any given level of enhancement at minimum cost is desirable. Cost minimization over time can be obtained only if enhancement production units are housed in institutions that a) are sufficiently flexible and have sufficiently strong economic incentives to respond to changes in market conditions and changing technology, b) will suffer directly (economically) if management fails to be cost conscious, and c) have sufficient incentive to carry out productive research and development. It would appear that cost minimization is much more likely to be approximated by private nonprofit hatcheries, in comparison to state hatcheries, in that the firm's management is answerable to the group whose net economic benefits from the hatchery (into which they are paying assessments) are directly and discernably affected by management decisions. In contrast, cost control in state hatcheries will be relatively difficult to maintain and there will be comparatively less incentive to be cost conscious.

---

[5]Investments by the state in state production hatcheries should be evaluated as to their economic feasibility, but it would be impossible and undesirable to require this for research hatcheries (see, for example, Zvi Griliches, Research Costs and Social Returns: Hybrid Corn and Related Innovations, *Journal of Political Economy*, Vol. LXVI, 1958.

The second basis for the implied preference for the private sector in the approach suggested above is that of economic equity. The equity principle is that those who receive the benefits from enhancement should pay the costs of the enhancement program. Given the present structure of fish taxation and the present or proposed state loan programs the private nonprofit hatchery would clearly be preferred on equity grounds also.[6] The preference for private-sector hatcheries for equity reasons would be less convincing if, accompanying investments in state hatcheries, there were flexible tax programs designed to recapture a high percentage of investment and operating costs. The primary danger of such a state hatchery and tax program is that, without effective cost control in the state hatchery program, the net benefits to the common fishery could be absorbed in taxes. This is in effect a restatement, in different terms, of the proposition above that whenever possible hatchery production units should be institutions that are flexible and have the appropriate economic incentives. For the state to finance *state* production hatcheries with fish taxes may be to endanger the original purpose of the enhancement program--to maximize net benefits to the common-property fishing units and the communities in which they reside--yet, equity requires that, if state production hatchery investments are made, there must be taxation of the intended beneficiaries to pay the costs. Given that there is a reasonable alternative to such an arrangement, it is difficult to see the justification for the present dual enhancement approach *unless* it follows the research-production and exempt-nonexempt dichotomies discussed above.

---

[6]The proposed state loan program is discussed on pp. 76-81.

The third basis for preferring private-sector production units concerns the marketing conflicts that are likely to develop between the state and the common-property fishery when returns to state hatcheries exceed the need for brood stock. It is easy to discount this *ex ante* but experience elsewhere suggests that it may become a significant problem.

To summarize, the approach suggested above for selecting between the public-sector and private-sector options, that of giving preference to private-sector hatchery investments unless there are compelling reasons to have a public hatchery (primarily research function, exempt species, located on interior river, etc.). This approach would allocate to the public and private sectors the roles shown in Table 18. The justifications

Table 18

Alaska Salmon Enhancement Program:

Suggested Institutional Distribution of Functions

Public-Sector Enhancement Functions	Private-Sector Enhancement Functions
Issue hatchery permits to nonprofit corporations	Organize regional nonprofit firms
Monitor hatchery operations	Arrange self-assessment and loan financing
Management of natural and hatchery stocks	Construct and operate production hatcheries for nonexempt species
Construct and operate research hatcheries	Make policy recommendations on state enhancement programs
Disseminate research results	
Construct and operate production hatcheries for exempt species	
Make policy recommendations on state enhancement programs	

for this division of responsibility are three: 1) that cost control is more likely to be achieved by private nonprofit hatcheries structured around the economic incentive

of self-interest, 2) that achieving economic equity is accomplished in nonprofit firms without compulsory taxation because beneficiaries accept financial responsibility for hatchery investment and operating costs, and 3) that for state owned and operated hatcheries there is the potential for serious marketing conflicts with the common-property fishery.

Other Institutional Options

The present statutes of the State of Alaska foreclose institutional options which may, under certain circumstances, be superior to either of the primary alternatives discussed above. Generalizing on the principles developed above, the more an institutional form incorporates the self-interest incentive the more likely it will be operationally efficient and progressive, and the greater the financial responsibility accepted by beneficiaries the more equitable and the more accute the self-interest incentive. These generalizations suggest that there are at least two additional institutional forms worthy of consideration, in that both are likely to be superior to presently authorized alternatives.

The first is the explicit profit-seeking firm. Accepting the political constraint discussed above as a given,[7] there is at least one circumstance where the spirit of that constraint can be retained without prohibiting explicit profit-seeking firms. This circumstance exists in areas where there is no established common-property fishery but where there appears to be considerable physical potential for enhancement. In such areas, as discussed on page 8, there is little incentive for either the state or

---

[7] It will be recalled that the political opposition is based on an almost universal belief among fishermen that their marketing position would be undercut by processor-controlled hatcheries, were profit-seeking hatchery firms legalized (see discussion on p. 67).

private nonprofit firms to develop a hatchery, but it is precisely to such areas where profit-seeking firms would be attracted. It could be argued that this option is already provided for by the entrepreneural type of nonprofit firm which is widely recognized as a form of profit-seeking firm. If this is the case, perhaps it would be better to allow these firms to take an explicit profit-seeking form. What is not widely appreciated is the fact that this change would represent a change of substance rather than merely a change of label. The economic substance of such a change would be that, by explicitly allowing profit-seeking firms in the undeveloped areas under consideration, venture capital and managerial skills could be attracted to the salmon enhancement program in amounts that are not likely to be approached under any of the other institutional options. Both venture capital and managerial skills are highly scarce resources in Alaska. It could be expected that, in time, a common-property fishery would develop off such sites and that after some period escapements to the hatchery would be reduced to the point where the profit-seeking firms would wish to sell their assets to regional nonprofit firms established by the newly formed offshore fishery.

The second potentially beneficial institutional option for private-sector hatchery development not presently allowed under state law is the restricted-stock profit-seeking firm, or cooperative. This form would retain the advantage of broad representation of the benefiting fishermen characteristic of the regional nonprofit firm, but it would enhance the self-interest incentive to be efficient and to progress. One way to ensure the success of this form would be to make the ownership of an entry permit conditional upon the ownership of a specified amount of stock and to make the stock transferable only with the transfer of the entry permit. Certain legal questions relating to this approach may need to be resolved, but it has great economic appeal.

Comparative Cost to the State

This section develops the implications for state expenditures of investments by the state in state and private nonprofit hatcheries under the present and proposed financial assistance programs for nonprofit firms. As discussed briefly in Chapter I, the present state program is one of providing long-term (25-year maximum) low-interest (eight-percent maximum) loans for hatchery construction to regional nonprofit firms of up to three million dollars but not to exceed 75 percent of the total project costs, and to other nonprofit firms of up to $300,000 per hatchery but not to exceed 75 percent of total project cost. Interest and principal payments may be deferred for up to six years, with interest compounding over the deferment period. The proposed program provides development grants of $100,000 per regional association and up to an additional $100,000 on a 50/50 cash matching basis. In addition, it would provide long-term (25-year maximum), low-interest (eight-percent maximum) loan equal in amounts to the existing program (except that they could be for up to 100 percent of total project cost within these ceilings) with a six-year deferment of repayment, and interest forgiveness over the six-year period. Table 19 shows the comparative direct commitment of public funds by the state for a private nonprofit hatchery, under these programs and for a state hatchery. These hatcheries are assumed to be identical in every respect, a reasonable assumption inasmuch as this exercise is designed to evaluate public and private hatchery investments as alternative institutional means of developing a specific hatchery site, for a specific species and capacity. It is legitimate, therefore, to look only at the cost side in this evaluation, because the flow of gross benefits can, as a first approximation, be considered to be independent of the

Table 19

Comparison of the Commitment of State Funds Required for Private Nonprofit Hatchery (Under Existing and Proposed Financing Programs) And for State Hatchery (Millions of Dollars)

A. Cost to State for Private Nonprofit Hatchery: Existing State Financing Program: ($.000)

Development costs	$ .200
Construction costs	1.800
Total	$2.000
Financed by:	
Assessments/grants	$ .500
State loan	1.500
Total	$2.000

Annual costs	Annual	Total Present Value
Loan repayment @ 8% (years 7-25)[1]	$.248	$1.500
Operating and maintenance (years 1-25)	.300	3.203
Total (years 7-25; $300,000 years 1-6)	$.548	$4.703

Financed by: Annual assessments and sales revenue. No cost to the state assuming earnings on other state investments ≤ 8%.

B. Cost to State for Private Nonprofit Hatchery: Proposed State Financing Program: ($.740)

Development costs	$ .200
Construction costs	1.800
Total	$2.000
Financed by:	
Assessments/grants	$ .000
State loan	2.000
Total	$2.000

Annual costs	Annual	Total Present Value
Loan repayment @ 8% (years 7-25)[2]	$.208	$1.260
Operating and maintenance (years 1-25)	.300	3.203
Total (years 7-25, $300,000 years 1-6)	$.508	$4.463

(Continued on next page)

Table 19 (cont'd.)

Financed by: Annual assessments and sales revenue. Cost to the state is the foregone interest income over the deferment period of $.740 (= present value of amount of loan less present value of payments = $2.000 - 1.260).

C. Cost to State for State Hatchery: ($5.203)

Development costs $	$ .200
Construction costs	1.800
Total	$2.000
Financed by state bond issue	2.000

Annual costs	Annual	Total Present Value
Bond issue repayment @ 8% (years 1-25)[3]	$.187	$2.000
Operating and maintenance (years 1-25)	.300	3.203
Total (years 1-25)	$.487	$5.203

Financed by: State's general fund ($5.203 in present value, $.487 annually).

D. Summary of Comparative Commitment of State Funds

	Private Nonprofit Hatchery		
	Existing Program	Proposed Program-	State Hatchery
Present value of capital cost	$2.000	$2.000	$2.000
Present value of down payment	.500	.000	2.000
Present value of loan repayments	1.500	1.260	.000
Present value of interest forgiveness	.000	.740	.000
Present value of operating and maintenance costs	3.203	3.203	3.203
Total costs in present value	5.203	5.203	5.203
Paid by nonprofit corporation	5.203	4.463	.000
Paid by state	.000	.740[4]	5.203

---

[1]Interest and principal payments deferred for six years with interest compounded over deferment period.

[2]Interest and principal payments deferred for six years, with interest forgiven over deferment period.

[3]Assumes bond issue is repaid over 25 years by equal annual payments into a sinking fund.

[4]Including the $200,000 hatchery-firm development grant the total direct commitment of state funds under this program to a single-hatchery firm would be $940,000.

institutional form of the hatchery unit.[8] Further, it is assumed in this analysis that level-two (and therefore level-three) feasibility have been established for the site in question. Consequently, the question of whether or not the hatchery should be built is answered affirmatively and it remains only to consider who (which sector) should build it.

In the example, it is assumed that construction costs for a remote 25 million egg hatchery are $1.8 million and that an additional $200,000 is required for site survey work, water-quality tests, preliminary engineering work, and the acquisition of necessary permits. Operating costs are assumed to be $300,000 per year. Further, since outlays occur at different points in time all values are discounted back to present value for ready comparability.

The present loan program involves no interest forgiveness and therefore the entire burden for repayment lies with the borrowing nonprofit firm; there is no explicit commitment of public funds. Private nonprofit firms would not be able to borrow below the market interest rate for relatively risky investments in the absence of the state loan program. The roughly two percent interest differential should not be counted as a cost to the state, however, unless it is established that the state could have earned commercial loan rates on alternative investments. What is involved here is the acceptance by the state of greater default risk than is normally assumed on state investments but the increased risk is at least partially offset by the ability of the state to develop mandatory assessment programs on existing salmon runs to ensure repay-

---

[8] This abstracts from a potentially serious disadvantage of state hatcheries discussed above, namely, the potential marketing conflicts that result when returns to the state hatchery exceed brood-stock requirements. This exercise also abstracts from the values created in fishing communities of allowing highly independent and self-reliant people provide their own enhancement program under their own control and direction, and on the cost side from the potential cost savings and technical advance associated with enhancement units having appropriate economic incentives.

ment.[9] It could be argued therefore that under this program the ultimate risk is borne by common-property fishing units.

The proposed revisions in the existing loan program are based on a recognition that the free-rider problems and extreme uncertainty forcing the regional nonprofit firms are likely to retard their development; that is, it is generally recognized that greater incentives are needed than provided by the existing loan program. There are two areas where revisions have been proposed: One is a development grant of $100,000 with an additional $100,000 on a 50 percent cash-matching basis. This grant would be designed to facilitate the formation of regional nonprofit associations; the additional matching portion is designed to encourage region-wide support for either a voluntary or mandatory (requiring a majority vote) self-assessment. The second revision that has been proposed is to forgive interest over the six-year deferment period. This is designed as an added incentive for regional nonprofit firms to assume the risks associated with salmon enhancement projects and, in particular, to allow these firms to resolve the cash-flow problems associated with hatchery investments. In particular, the sharing of risks implicit in this proposal, by sharing the initial financial burden, allows the regional nonprofit firm to propose assessment programs to the fishermen within a region that are less weighted toward front-end commitments. This proposal is consistent with its counterpart in attempting to overcome the economic disincentives associated with the free-rider and uncertainty characteristics of the present economic environment facing salmon enhancement investments. The total present value of costs to the state for a $2 million hatchery is $940,000, $750,000 in interest forgiveness and $200,000 development grant. The latter is available only

---

[9]Alaska Statutes, Sec. 16.10.530 (a) - (d).

once for each regional nonprofit association so that subsequent hatcheries built by an association would cost the state $740,000 in direct subsidy.

An alternative to a private nonprofit hatchery is a hatchery constructed and operated by the state. Table 19 lays out the costs assumed by the state for this alternative ($5.203 million in present value). A politically probable result of adopting this alternative is the imposition of fish taxes to pay these costs. It might be argued therefore that the presentation in Table 19 is misleading in that it implies that these costs will be covered from existing revenue sources. Such would be the case, however, without an explicit change in fish-tax laws.

The reader will recognize that what is involved here is the basic and by now familiar question of whether, if fish-tax laws are changed to cover the cost of state enhancement projects, fishermen and fishing communities might not be better served by enhancement projects which they finance, control, and operate themselves, and whether or not the other citizens of Alaska are not better served by entrusting state investments in salmon enhancement production units to institutions that have the necessary economic incentives to be cost efficient and to be scientifically and technologically progressive. These are questions on which every serious policy maker must reflect as additional public investments in salmon enhancement production units are considered.

CHAPTER IV

SUMMARY AND CONCLUSIONS

The primary purpose of this report is to identify and evaluate public-policy issues relating to Alaska's salmon enhancement program while focusing on the role of private nonprofit hatchery firms. This was accomplished by means of a pilot economic feasibility analysis of the Port San Juan Hatchery owned by the Prince William Sound Aquaculture Corporation.

This report includes a discussion of economic incentives implicit in the present economic environment facing nonprofit hatchery firms (Chapter I); a formal economic feasibility analysis using the net present value format (Chapter II); and an analysis of present public policy toward salmon enhancement in Alaska (Chapter III). The findings with respect to each of these topics are summarized briefly below.

The success, and degree of success, of salmon enhancement investments by nonprofit firms depends importantly on the ability of these firms to effectively harness the latent and widely dispersed economic incentives that exist among potentially benefiting fishermen. Working against their accomplishing this are vaguely defined property rights and the associated "free-rider" problem, and extreme uncertainty about future benefits (see pp. 6-11). Countervailing influences in their favor are financial incentives provided by the state and the Alaska limited-entry program for salmon.

The feasibility analysis reveals that, with presently available information about costs, prices, and biological survival rates, hatchery investments by nonprofit firms are economically feasible, assuming that a continuous assessment program is sup-

ported by benefiting fishermen. Assessments are required because hatchery revenues from the sale of returning surplus salmon will not be sufficient to cover costs at their present levels. Assessments are economically justified because the fishermen will receive positive net benefits (after allowing for assessments paid) as a result of the productive activity of the hatchery (see pp.48-57). The feasibility analysis also demonstrates that the amount of the required assessments and the resultant net benefits received by fishermen are going to be determined by, and highly sensitive to, innovations which increase ocean survival and those which reduce investment and operating costs (see sensitivity analysis contained in Figures 6-8, pp.49-51; Table 15, pp.53-55; Table 16, p.58; and Table 17, pp.59-61). It is apparent that such innovations can convert what appear at present to be marginally profitable investments into highly profitable ones. It is also apparent that the *social* function of the nonprofit hatchery firm will be to provide the institutional framework for focusing otherwise highly dispersed economic self-interest incentives into an economic production unit that has the incentive to produce cost-decreasing and productivity-increasing innovations. It is this incentive structure which constitutes the primary characteristic, in addition to the important question of who is going to pay for salmon enhancement production units, distinguishing the private sector and the public sector enhancement approaches.

The third chapter presents a review and analysis of Alaska public policy toward private nonprofit salmon hatcheries. Because of the obvious interdependencies, this discussion includes the dual-hatchery-program concept and other private-sector institutional forms presently excluded by statute. With respect to the latter, two alternatives to the nonprofit approach are apparent. One is to allow profit-seeking

firms to enter the hatchery business. Because of a pervasive political constraint, however (see p. 67), entry of such firms would probably necessarily be restricted to areas not presently supporting a common-property fishery, but which have biological potential (p. 74 and 75). The other alternative would be to encourage the restricted-stock, or cooperative, type profit-seeking firm. The advantages of this approach are impressive (see p. 75).

The most fundamental policy question facing the State of Alaska with respect to its salmon-enhancement program pertains to the allocation of public funds between state hatcheries and private-nonprofit hatcheries. One approach worthy of consideration is to require functional specialization based on a composite of biological and economic considerations (see pp. 70-74). The ultimate financing of the salmon enhancement efforts is a question that is closely related to the issue of allocating public funds (see pp. 76-81, especially Table 19, pp. 77 and 78). As a generalization, the cost of state constructed and operated hatcheries are borne by the general Alaska public and the primary beneficiaries are fishermen, processors and consumers of salmon products. Virtually all of the last group are nonresidents. An explicit revision in fish-tax laws would be required to modify these distributional consequences. A companion generalization is that the cost of private nonprofit hatcheries are borne exclusively or primarily by the benefiting fishermen (see Table 19, pp. 77 and 78) and that these costs will enter the price structure and be passed on in part to buyers.

APPENDIX

Table A-1

Construction Cost Categories

Water System

Water control dams
reconstruction, repair, grouting, flashboards, gate control structures

Construction of:
Lake-intake pipe system
400 feet of 12-inch polyproplyn pipe
Lake-intake strainer
Valve house
10 foot by 10 foot two-story associated valve control structure
Main pipeline
2,500 feet of 12-inch insulated heat-traced aluminum-clad water pipe
74 separate pipe-support trestles
Cabling and chocking
Six thrust-blocks leading to the tankhouse
Tankhouse--three-story wood frame structure
One 12-foot diameter and two 10-foot diameter redwood tanks
160,000 BTU forced-air firnace
Electric lighting
Associated pipeline valves, outlets, overflows, tank aerator, and terminal control
Instrumentation indicating water flow and temperature
Low-water alarm

Incubation/Production System

Freshwater system in the incubation building including:
Strainer
Orifice plate
Incubator supply drop-control valves
7 recirculation pumps
Piping system
Incubator supply drops, control valves, and biological filters
Saltwater treatment system
Saltwater pump
Over 400 feet of pipe
Intake strainer
Distribution system
72 incubator boxes fitted with astroturf to serve as substrate collection troughs
Holding and recirculation tanks

(Continued on next page)

Table A-1 (cont'd.)

Incubation Building

Foundation, areawalks, and additional pilings to support increased floor load of building

Tank room--houses the recirculation system
- Concrete troughs, grating, and electric wiring
- Oil-fired boiler
- Water circulation pumps
- Domestic water take-off system

Main floor--incubation room
- Laboratory and lab equipment
- Materials of sheetrock wainscoating, windows, doors and necessary columns

Second floor
- Biologist quarters
- Transient quarters
  - Two bathrooms, seven double bedrooms, and cooking facilities
- Materials needed for second floor:
  - Partitioning lumber, sheetrock, textured ceilings, rugs, furniture, linoleum, two complete kitchens, and three bathrooms
- Three stairwells constructed in accordance with State of Alaska Fire Marshall requirements

Utility System--Waste Treatment

Installation of two-tank multiflow sewer system to provide secondary treatment of waste water
- 400 feet of four-inch waste line and outfall line from sewer tanks to the outfall
- Domestic water and waste system in incubation building, tankhouse and biologist quarters
- Heating system
- Separate fire protection water system

Electric Power Generation/Distribution

Construction and installation of:
- Pelton wheel hydroelectric power installation (provides for electric power by using the water from the main water pipeline)
  - Peltons, valves, terminal control, and related plumbing materials
- Standby generators (one 50 KW and one 30 KW)
- Generator house--15 feet by 20 feet
- Power distribution and wiring
  - Electric panels with gear, hatchery wiring and outside lighting
- Wiring of 2,500-foot heat-trace wire on pipeline to keep pipes from freezing

(Continued on next page)

Table A-1 (cont'd.)

Miscellaneous

Components and systems necessary for hatchery operation

7,000 gallon fuel tank storage capacity

Maintenance shop
Welds, table saws and aircraft float to allow for the arrival and departure of aircraft

Improvements for watchman's quarters--a two-bedroom single-family dwelling

Construction of egg-take floats and other egg-take equipment for conducting an egg take to receive necessary brood stock

Demolition and removal to provide for fuel used on site, including diesel, lube oil for generators, stove oil, and gasoline

Small tools
Hand tools for construction
Power equipment for construction

Estimated market value of donated services and materials
(See Appendix Table A-2 for detail)

Camp Cost

Installation of cookhouse

Groceries to feed the crew
27 people, on the average, to be fed for the construction period from May 15 to November 1, 1976

Cleaning supplies

Radio equipment for two-way communication between Cordova office and Port San Juan

Engineering

Preliminary engineering

Basic design engineering

Resident inspection

Engineering permit assistance

Associated direct costs of engineering

(Continued on next page)

Table A-1 (cont'd.)

Project Administration

Salary of project coordinator

Salaries of office staff associated with:
Construction
Administration at the site
Insurance
Workmen's compensation

Associated project costs of audit as required by Economic Development Administration and the State of Alaska, Department of Commerce

Telephone charges associated with construction and procurement of materials

Work permits for various regulatory agencies

Acquisition, Shipment and Distribution

Freight by air, sea, land, boat charter, and associated boat charter expenses

Transportation of construction crew

Loading, unloading and moving materials in Cordova and on job site

Procurement of materials
Expediting in Seattle
Assistance from engineers
Movement of materials in Cordova

Interest

Interim financing

Vendor's interest

Bank service charges

Estimated implicit interest on contributed capital
(See Appendix Tables A-3 and A-4 for detail)

Undistributed Construction Costs

Costs of construction materials that have been received before the costs can be distributed to the proper construction account
(Example: An invoice might show 400 sacks of cement. This invoice would be put in the undistributed costs until it is determined where the cement was used.)

Table A-2

Statement of Donated Construction Services and Materials

Year	Description of Donation	Estimated Value
1975	Boat Charter	$60,912
1975	Materials	1,187
1975	Labor (1759.5 hrs. @ $6.50)	11,437
1975	Helicopter	10,000
1975	Total	83,536
1976	Boat Charter	58,400
1976	Labor	3,000
1976	Helicopter	6,000
1976	Total	67,400
	Total	$150,936

Table A-3

Schedule of Implicit Interest on Contributed Capital @ 8%

Date Rec'd.	Single Payment Compound Amount Factor[1]	Fishermen Assessment	Interest on Fishermen Assessment	Processors Assessment	Interest on Processors Assessment	Tendermen Assessment	Interest on Tendermen Assessment
1975							
Jan	.16640	$	$	$	$	$	$
Feb	.15894						
Mar	.15153						
Apr	.14417						
May	.13686						
Jun	.12959	663.08	85.93				
Jul	.12237	19,140.84	2,342.26	18,267.98	2,235.45		
Aug	.11519	85,457.13	9,843.81	63,011.30	7,258.27		
Sep	.10806	8,579.90	927.14	8,252.78	891.80	410.68	44.38
Oct	.10098					745.50	75.28
Nov	.09394					500.00	46.97
Dec	.08695						
1976							
Jan	.08000	13.42	1.07	8,479.13	678.33		
Feb	.07310			16,000.00	1,169.60		
Mar	.06624						
Apr	.05942						
May	.05265						
Jun	.04592	2,764.20	126.93	2,764.20	126.93		
Jul	.03923	27,274.60	1,069.98	20,587.60	807.65		
Aug	.03259	406.82	13.26	968.05	31.55		
Sep	.02599	31,633.73	822.16	36,163.20	939.88		
Oct	.01943	25,659.25	498.56	24,232.32	470.83	554.00	10.76
Nov	.01291	13,427.80	173.35	476.42	6.15		
Dec	.00643			8,652.92	55.64		
Totals		$215,020.77	$15,904.45	$207,855.90	$14,672.08	$ 2,210.18	$ 177.39

(Continued on next page)

Table A-3 (cont'd.)

Date Rec'd.	Misc. Grants[2]	Interest on Misc. Grants	EDA Grant	Interest on EDA Grant	CETA Funds[3]	Interest on CETA Funds	Total Contributed Capital	Total Interest on Contributed Capital
1975								
Jan	$	$	$	$	$	$	$	$
Feb					532,83	84.69	532.83	84.69
Mar	5,000.00	757.65			912.63	138.29	5,912.63	895.94
Apr	5,000.00	720.85			912.63	131.57	5,912.63	852.42
May								
Jun	1,629.88	211.22			912.63	118.27	3,205.59	415.42
Jul	423.11	51.78			912.63	111.68	38,744.56	4,741.17
Aug	5,841.08	672.83			912.63	105.13	155,222,14	17,880.04
Sep	1,600.00	172.90			912.63	98.62	19,755.99	2,134.84
Oct	168.99	17.06			912.63	92.16	1,827.12	184.50
Nov					912.63	85.73	1,412.63	132.70
Dec	986.14	85.74			912.63	79.35	1,898.77	165.09
1976								
Jan							8,492.55	679.40
Feb							16,000.00	1,169.60
Mar			396,720.00	26,278.73			396,720.00	26,278.73
Apr	150.00	8.91					150.00	8.91
May								
Jun	4.00	.18			1,500.00	68.88	7,032.40	322.92
Jul	550.00	21.58					48,412.20	1,899.21
Aug					9,203.39	299.94	10,578.26	344.75
Sep					7,991.24	207.69	75,788.17	1,969.73
Oct	186.63	3.63			12,678.27	246.23	63,310.47	1,230 12
Nov			44,000.00	568.04	2,209.00	28.52	60,133.22	776.06
Dec							8,652.92	55.64
Totals	$21,539.83	$ 2,724.33	$440,720.00	$26,846.77	$42,328.40	$ 1,896.86	$929,675.08	$62,221.88

[1]Derived from $(1 + i)^t$, where i = interest rate and t = number of years (i.e., Dec. 1976 = 1/2, Jan. 1976 = 12/12, and Dec. 1975 = 13/12, etc.).

[2]Includes $10,540 of fishermen and other individual contributions, $10,000 from municipalities, and $1,000 from banks.

[3]Employee salary grants from State of Alaska.

Table A-4

Revenue and Cost Flows:
Moderate-Productivity Case and Mid Range O & M Cost

Year	Costs	Sales Revenue	Assessment Revenue	Total Revenue[1]	Cumulative Net Revenue	Interest Expense @ 10%
0	$2,066,061	$ 0	$ 0	$ 0	$ -2,066,061	$
1	370,000	0	0	0	-2,642,667	206,606
2	370,000	0	0	0	-3,276,934	264,267
3	370,000	306,518	436,679	743,197	-3,231,430	327,693
4	370,000	306,518	436,679	743,197	-3,181,376	323,143
5	370,000	306,518	436,679	743,197	-3,126,317	318,138
6	370,000	306,518	436,679	743,197	-3,065,752	312,632
7	370,000	306,518	436,679	743,197	-2,999,130	306,575
8	370,000	306,518	436,679	743,197	-2,925,846	299,913
9	370,000	306,518	436,679	743,197	-2,845,234	292,585
10	370,000	306,518	436,679	743,197	-2,756,560	284,523
11	370,000	306,518	436,679	743,197	-2,659,019	275,656
12	370,000	306,518	436,679	743,197	-2,551,724	265,902
13	370,000	306,518	436,679	743,197	-2,433,699	255,172
14	370,000	306,518	436,679	743,197	-2,303,873	243,370
15	370,000	306,518	436,679	743,197	-2,161,062	230,387
16	370,000	306,518	436,679	743,197	-2,003,971	216,106
17	370,000	306,518	436,679	743,197	-1,831,171	200,397
18	370,000	306,518	436,679	743,197	-1,641,091	183,117
19	370,000	306,518	436,679	743,197	-1,432,003	164,109
20	370,000	306,518	436,679	743,197	-1,202,006	143,200
21	50,000	306,518	436,679	743,197	- 629,010	120,201
22	50,000	306,518	436,679	743,197	1,286	62,901
Present Value	5,229,136	2,156,661	3,072,475	5,229,136	-	-

[1]Total revenue includes sum of assessment revenue and sales revenue. Assessment revenue has been calculated at the minimum annual payment in years 3-22 necessary to make NPV = 0 (see Table 15). Total revenue, therefore, is calculated to yield sufficient revenue to cover all costs. Costs include $2,066,061 initial investment cost, $370,000 operating costs in years 1-20, $50,000 operating costs in years 21 and 22, and working-capital cost at 10 percent.

LIST OF REFERENCES

Alaska Department of Fish and Game, 1977. Division of Fisheries Rehabilitation, Enhancement and Development, Report to the 1977 Legislature, Juneau.

Griliches, Zvi. 1958. Research Costs and Social Returns: Hybrid Corn and Related Innovations. *Journal of Political Economy*, Vol. LXVI, October.

Im, Kwang, Richard Johnston, Don Langmo. 1976. The Economics of Hatchery Production of Pacific Oyster Seed: A Research Progress Report. *Proceedings*. National Shellfisheries Association.

Lindstrom, Sandra. 1977. Personal Interview Alaska Department of Fish and Game. Juneau.

McNeil, William J. and Jack E. Bailey. 1975. Salmon Ranchers Manual. Northwest Fisheries Center (Processed Report). Department of Commerce, National Marine Fisheries Service. Seattle.

Orth, Franklin L. 1975. Economic Feasibility of Private Nonprofit Salmon Hatcheries: An Introduction. *Aquaculture Notes*, Sea Grant Report 75/13, Alaska Sea Grant Program, University of Alaska, Fairbanks.

Orth, Franklin L. 1976a. The Economic Implications of Alternative Forms of Business Organization for Alaska Salmon Ranching Ventures. *Proceedings Conference on Salmon Aquaculture*. Alaska Sea Grant Program, University of Alaska, Fairbanks.

Orth, Franklin L. 1976b. Alaska's Evolving Salmon Aquaculture Policy: An Economic Perspective. Unpublished paper delivered at the 27th Alaska Science Conference, University of Alaska, Fairbanks.

Robinson, E. Thomas. 1976. Alaska Statutes: Commercial Fishing Loan Act, Salmon Hatcheries, and Fisheries Enhancement Loan Program, *Aquaculture Notes*. Sea Grant Report 76/17. Alaska Sea Grant Program, University of Alaska, Fairbanks.

Shapiro, Edward. 1974. *Macroeconomic Analysis*, Third Edition. Harcourt Brace Jovanovich, Inc. New York.

Presented by the Sea Grant Programs of the University of Alaska and the University of Wisconsin in cooperation with the University of Washington Sea Grant Program and the AIME. The National Sea Grant Program is a part of the National Oceanic and Atmospheric Administration, U.S. Department of Commerce.

UNDERWATER MINING INSTITUTE: November 10-11, 1977

Name _____

Title/Position _____

Company/Institution _____

Address _____

City _____ State _____ Zip _____

Office Tel. No. _____

MAIL TO: Sea Grant Advisory Services
1815 University Avenue
Madison, Wisconsin 53706

FEE: $150.00. Please enclose enrollment fee. Make checks payable to University of Wisconsin–Extension.

Clip & Mail

Eighth Underwater Mining Institute

November 10 & 11

THURSDAY, NOVEMBER 10

8:00 Registration opens

9:00 Gregory D. Hedden, Program Coordinator
Call to Order
Stanley R. Murphy, Director, University of Washington Sea Grant Program, Seattle, Washington
Welcome
J. R. Moore, Program Chairman
Overview of the Institute

9:15 James L. Johnston, Senior Economist, Standard Oil Company (Indiana), Chicago, Illinois
An Economic Analysis of the Alternative Legal Regimes for Deep Seabed Mining

10:00 Coffee

10:15 Leigh Ratiner, Partner, Dickstein, Shapiro & Morin, Washington, D.C.
Reflections on the 1977 Law of the Sea Conference and the Prognosis for Ocean Mining Legislation

11:00 Arthur S. Westneat, Jr., Consultant, Middletown, Rhode Island
Shallow Penetration Geophysical Systems in Marine Mineral Exploration

11:45 Discussion

12:00 Lunch
Ben Russak, President and Publisher, Crane Russak and Company, Inc. New York, New York
Presentation of new journal, **Marine Mining**

P.M.

1:30 Charles L. Morgan, Research Scientist, Lockheed Ocean Mining Program, San Diego, California
A New Look at Manganese Nodule Growth Processes—Some Practical Implications of the Current Models

2:30 Refreshments and Discussion

3:00 John E. Noakes, Director, Geochronology Laboratory, University of Georgia, Athens, Georgia
Undersea Mineral Exploration with Nuclear Tools

4:00 Adjourn

5:30 Cash Bar, Olympic Hotel

6:30 Dinner, Olympic Hotel
J. R. Moore
New Frontiers in Marine Minerals Exploration and Mining

FRIDAY, NOVEMBER 11

9:00 Martha H. Kohler, Specialist, Environmental Services Department, Bechtel Corporation, San Francisco, California
Environmental Issues: Mining in the Coastal Zone

9:45 Coffee and Discussion

10:15 Charles M. Hoskin, Professor of Marine Geology, Institute of Marine Science, University of Alaska, Fairbanks, Alaska
Marine Mining in Alaskan Coastal Waters

11:00 Cleland Conwell, Mining Engineer, Alaska Department of Natural Resources; Director, Geological and Geophysical Surveys
The History, Present Legal Regime, and Future of Underwater Mining in Alaska

11:45 Lunch

P.M.

1:15 Paul Swatek, Associate Conservation Director, Sierra Club, San Francisco, California
A Conservationist Looks at Marine Mining

2:15 Panel Discussion on Critical Environmental, Law of the Sea and Economic issues

3:45 Announcements

4:00 Adjourn


Hoskin


Conwell


Swatek


Johnston


Ratiner


Westneat


Morgan


Noakes


Kohler


Hedden

J. R. Moore, Program Chairman

Dear Colleague:

The Eighth Underwater Mining Institute, November 10-11, 1977 is a new cooperative endeavor this year. The program is jointly sponsored by the University of Alaska and the University of Wisconsin and will be held in Seattle with the cooperation of the University of Washington Sea Grant Program.

The changing events in the world scene of legal, political and economic factors and the technological developments and environmental concerns continue to recommend an annual update. The early, rather special pioneering group in this field has been joined by others in recent years to make an exciting meeting, and we especially welcome newcomers who might wish to combine this Institute with the GSA meeting earlier in the week in the same city and/or the meeting of the Society of Engineering Geologists.

Whether you have been a regular participant in the past or represent a new interest in the field, do plan to join us and your colleagues in this eighth annual event.

J. R. Moore, Director
Institute of Marine Science
University of Alaska
Fairbanks, Alaska

General Information

Enrollment:
Payment of the program fee should accompany each enrollment. It covers the cost of sessions, handout materials, noon lunches on November 10 and 11, evening dinner on November 10, and refreshment breaks. Lodging is *not* included. Advanced enrollment is recommended and should be received in Madison no later than November 4.

Registration and Meeting Place:
Registration and sessions are scheduled in The Olympic Hotel, Fourth at Seneca, Seattle. The registration desk for the Institute will open at 8:00 a.m. on November 10 at the Georgian Room. All sessions will be held in the Georgian Room.

Lodging:
A block of single rooms has been reserved at The Olympic Hotel, Seattle, with a *cutoff date of October 9.* After this date, requests for reservations will be honored on the basis of available space. You should make hotel reservations directly with the hotel as soon as possible and specify the name of the meeting to receive the guaranteed rate and priority booking. Address: The Olympic, Fourth at Seneca, Seattle, Washington 98111. Telephone: (206) 682-7700.

Refund:
Full refund of fee payment will be made if program is cancelled or notice of cancellation by enrollee is received by November 4, 1977.

For Advance Course Information and Enrollment:
G. D. Hedden, Program Coordinator,
University of Wisconsin, Sea Grant Advisory Services
1815 University Avenue, Madison, Wisconsin 53706
608/262-0644

For Telephone Contact During the Institute in Seattle:
The Olympic Hotel, 206/682-7700

NO PROCEEDINGS WILL BE PUBLISHED.

14000-4D7T014-77

EIGHTH UNDERWATER MINING INSTITUTE
November 10-11, 1977
Seattle, Washington

University of Wisconsin-Extension
Sea Grant Advisory Services
1815 University Avenue
Madison, Wisconsin 53706

UNIVERSITY OF ALASKA
A Publication of the Alaska Sea Grant Program

Volume 5, Number 4
October 1977

ALASKA Seas and Coasts
A Newsletter for the Alaska Commercial Fishing Industry

JAPANESE INVESTMENT IN ALASKA'S FISHING INDUSTRY

The rich fisheries of the Bering Sea and the Gulf of Alaska have historically attracted large foreign fleets. As of August, 1977, the National Marine Fisheries Service reported 356 foreign fishing vessels in the U.S. 200-mile zone off Alaska. By country these break down to: Japanese – 337; South Korean – 10; Soviet – 7; and Nationalist Chinese – 2.

The dominance of the Japanese fleet is obvious. Japanese efforts to acquire seafood products, however, are not limited to the catch of this high seas fleet. In this first portion of a two-part feature article, Per O. Heggelund examines the second element of Japan's quest for high quality seafood: investment in shore-based U.S. seafood processing plants prior to the 200-mile limit.

By Per O. Haggelund
Marine Advisory Program
University of Alaska
Anchorage, Alaska

With no significant natural resources other than her 110 million people, Japan has had to import both food and the raw materials needed to sustain a modern economy. Indeed, 90 percent of her food is imported, making overseas procurement a vital aspect of her economic development.

CHANGES IN JAPAN'S SEAFOOD CONSUMPTION

Marine products have remained a staple in the Japanese diet for centuries. Since 1960, however, there has been a steady decline in the dietary proportion of seafood. This decline primarily reflects the change in the living standards of the Japanese people. They now rely more on meat products for their animal protein needs. There has also been a gradual growth in the preference for higher-value or specialty marine products which Japan has imported at an increasing rate.

In order to accommodate this increased demand for specialty seafoods, import controls on most of these fishery products were lifted in the early 60s. These events coincided with Japanese businessmen initiating the purchasing of Northeast Pacific (NEP) salmon roe.

MAGNITUDE OF THE INVESTMENT

Foreign investment in the U.S. fishing industry totaled $129 million by the end of 1974. The investment was spread among 47 firms reporting foreign ownership of ten percent or more of the voting stock. These companies reported a total sale of $570 million of which $235 million were sales by fisheries processing firms and $292 million by wholesaling firms. The U.S. market share of these affiliates was eight percent and six percent, respectively.

Although foreign investments comprise only a minor part of the entire U.S. commercial fishing industry, the investment has almost doubled since 1970. During 1974 alone, direct investment rose some 30 percent. These foreign investments have been made predominantly through debt items (for example, bonds and notes) representing 66 percent of total claims against assets. Moreover, the foreign investors have tended to concentrate their establishment in the Northeast Pacific. Approximately one-third of the establishments are located in Alaska.

INVESTMENT PATTERNS IN ALASKA

Foreign investments in Alaskan and NEP fisheries enterprises have been dominated by the large Japanese general trading companies (Sogoshosha) and fishing firms: C. Itoh, Marubeni, Mitsubishi, Mitsui, Hokayo, Kyokuyo, Nichiro Gyogyo, and Taiyo Gyogyo. These Japanese companies have applied a foreign investment strategy in this area which differs significantly from the general trend observed in the fishing industry across the nation.

Wheel Watch

WHEEL WATCH, a new column for readers' comments, appears for the first time in this issue. Read all about it on page 10.

First, the Japanese have tended to concentrate their investment in equity items (stocks — 66 percent) rather than debt items. Second, the trading and fishing companies initiate their investments by means of consortiums.

CONSORTIUMS

Although this latter investment strategy is not commonly observed among other foreign investors in the U.S. fishing industry, it has formed an important part of the Japanese multi-national strategy. During the latter part of the 60s, the Japanese fishing firms and trading companies changed their product procurement strategy in the NEP from straight purchasing to equity participation in the local seafood processing establishments.

Taiyo Fishery Co., Ltd. (Taiyo Gyogyo Kabushiki, Ltd.), as the leading fishing concern in Japan with an annual sale of $2.5 billion in 1974, led the way in equity investments in the NEP. In 1965, Taiyo bought 49 percent of Pacific Alaska Fisheries in partnership with Peter Pan Seafoods. Two years later, the same Japanese fishing company incorporated Western Alaska Enterprises as a subsidiary of Taiyo California.

Western Alaska Enterprises, originally established as a holding company with marginal involvement in direct seafood production, only represents the parent company with on-site management and production supervision in plants throughout the NEP. In view of this strategy, Taiyo formed B & B Fisheries in 1967 by signing 70 percent of the stocks to Western Alaska Enterprises and the remaining portion to a local Kodiak processor. This strategy of local participation, however, changed in the mid-70s as Taiyo acquired all the outstanding shares of B & B.

SPECIALTY PRODUCTS

The aggressive investment strategy of Taiyo followed a growing interest by Japanese concerns in a variety of specialty products or underutilized products by domestic standards. Tanner crab, for example, faced an uncertain market in the U.S. Then in the early 70s Japanese interests began purchasing large quantities of tanner crab sections (a semi-processed product) thereby providing the industry with a necessary growth stimulus. This increased demand caused the fishery to expand from 13 million pounds in 1971 to 61 million pounds in 1973.

The growing demand for specialty products prompted other Japanese fishing and trading companies to invest in the NEP. During the late 60s the first Japanese consortium obtained equity participation in one processing establishment. In 1966 Nichiro Gyogyo Kaisha, Ltd. (Japan's third largest fishery company) and Mitsubishi Shojiku (Japan's largest general trading company) in partnership with New England Fish Company, formed Orca Pacific Packing Company in Cordova. Except for Nichiro establishing a U.S. subsidiary, Nichiro Pacific, Ltd., this investment was the last reported Japanese equity participation in the Northeast Pacific during the 60s.

INVESTMENT RATE

The rather slow investment rate was maintained despite the Fisheries Agency of the Japanese Ministry of Agriculture and Forestry's estimate that after 1965 a gradual domestic seafood deficit would become apparent. The Ministry projected that by 1971 one-half million metric tons had to be imported to meet the growing demand. Since fishery products would not represent any major portion of total imports, the Japanese government did not seem concerned with the prevailing trade imbalance. In fact, the value of seafood imports did not exceed exports until 1972.

The widening trade imbalance of seafoods may in part have caused the Japanese investors' renewed interest in the NEP fishing industry. In 1972 and 1973 alone, 14 reported investments were initiated. This investment surge represented a threefold increase over the accumulated investment level since 1965.

The explosive growth in Japanese investment in the NEP fishing industry coincided with a general surge in Japanese foreign ventures. This accelerated investment rate resulted from Japan's economic strategy in dealing with her mounting foreign exchange reserves in the late 60s and early 70s.

First, the government removed most restrictions on overseas investment in order to stimulate capital outflow.

Second, in 1972, the previous administrative policy had not significantly reduced the foreign exchange surplus. The yen was effectively revalued 17 percent in relation to the U.S. dollar, thereby equivalently discounting United States assets.

Third, in 1973 the Japanese government in cooperation with the fishing companies, specifically began promoting overseas investments in fisheries by forming the Overseas Fisheries Cooperation Foundation. The primary function of this organization was to provide credit for companies engaging in off-shore economic and technical cooperation.

The Japanese government's economic incentives toward overseas investments, particularly in fisheries, resulted in the formation of partnerships in the NEP by the new investors. In 1973, the Nippon Suisan Kaisha, Ltd.-Mitsui and Company, Ltd. consortium (Japan's second largest fishery and trading companies respectively) purchased 37.6 percent in Morpac, Inc., which was formed in 1968 by a group of Cordova residents. The same consortium bought controlling interests of the firm in 1976, thus increasing its total capital commitment in the NEP at par with both Taiyo and the Nichiro-Mitsubishi consortium. This strengthening of Nippon-Suisan's consortium strategy appeared despite their formation of three partnerships outside the consortium in the mid-70s.

The strategic position of the consortium in the NEP began deteriorating during the 1972-1973 investment surge. The fishery companies probably possessed some degree of managerial and technical advantage over the trading companies, as the former consortium partners were able to form local partnerships without the aid of the trading companies. These inherent advantages of the fishery firms, however, were abruptly challenged with the aggressive investment policy of Marubeni.

Marubeni-Iida Co., Ltd., the third largest Japanese trading company and the largest marine product importer, committed $1 million among three different NEP establishments in June 1972. The following year this company invested in the firm additional processors, making it the most diversified Japanese investor in the NEP.

Meanwhile Kyokuyo, as with the other Japanese investors in the NEP, committed its capital in seafood processing rather than direct fishing operations. The reasons for this apparent corporate strategy may be found in the inherent structure of the Northeast Pacific fishing industry, Japanese foreign investment regulation, and U.S federal marine regulations.

PERSPECTIVE

The U.S. federal merchant marine laws limit the operation and ownership of

(Continued on Page 8)

COMMERCIAL FISHING LOANS

Where to . . .

How to . . .

By
Craig Wiese and Peggy Parker
Marine Advisory Program
University of Alaska
Cordova, Alaska

Getting a commercial fishing loan need not be as formidable as tradition has made it out to be. There are more loan sources and loan opportunities than most fishermen realize.

No lender will be willing to finance a project which is clearly not economical. But it is probable that a fisherman could find as many different opinions on the soundness of a marginal, or even good fishing investment and the fishermen behind it as there are lenders to review it.

The fisherman armed with a well prepared investment proposal and some experience in the fishing industry is likely to find that funding is available for almost any reasonable fishing project.

The following list of loan sources for Alaska's commercial fishermen is not complete. It includes only the more conventional lending agencies which are in business to solve the financial problems that most fishermen face at one time or another.

If one of these agencies cannot help, then private lenders and venture capitalists are the next likeliest sources to turn to. The description following each loan source includes only the basic points, and interested fishermen should investigate each source thoroughly before making a committment.

State of Alaska: Commercial Fishing Revolving Loan Fund

This state-sponsored loan is available to Alaskan fishermen who have been residents for five years and have held a commercial fishing license for three years. The program is not open to non-residents.

Loans up to $150,000 can be arranged. The repayment period may not exceed 15 years, and the annual interest rate is held at an unbeatably low 7 percent.

The loan funds must go toward repair, restoration, or upgrading of existing vessels and gear, or for the purchase of vessels, new or used. The loan may also be used to finance purchase of an entry permit.

All collateral must be professionally appraised. And, if the collateral is a vessel, a marine survey or new construction estimate must accompany the loan application. No loan will be made for more than 75 percent of the value of the collateral offered to secure the loan.

A service fee of .5 percent will be charged borrowers. This .5 percent will be "revolved" back into the loan

appropriation's fund; it's the state's way of creating a "revolving loan fund."

Income tax returns, business and personal resumes, and financial statements must accompany an application. Application forms and a complete list of pertinent information required to secure the state loan can be obtained by writing:

Dept. of Commerce & Economic Dev.
Division of Business Loans
Pouch D
Juneau, Alaska 99811
(907) 465-2510

An attractive aspect of the state fishing revolving loan fund is that amortization plans for repayment of the loan may include extensions for poor fishing seasons.

State of Alaska: Small Business Loan

This financing is available for Alaska's tender/packing-type vessels and to Alaskan canneries and other businesses related to the fishing industry which are not eligible for a state commercial fishing loan.

Eligibility rests on the business' potential for growth and its contribution to employment in the community. The applicant must also be a resident, employ less than 50 people and make less than $2 million in annual gross sales.

As of September 18, 1977, the ceiling on the State Small Business Loan is $300,000. Loans secured by real estate may be amortized over 15 years. The state will normally consider loaning up to 75 percent of the appraised value of real estate offered, and up to 60 percent of the appraised value of equipment and machinery offered as collateral.

Interest is charged at 8 percent per year. Applications may be obtained by writing to the Dept. of Commerce and Economic Development at the address given above.

Bureau of Indian Affairs (BIA)

Loans from the Bureau of Indian Affairs are available to fishermen who are one-quarter or more Alaskan Native. Application is made through the local BIA Agency Credit offices located in Anchorage, Juneau, Fairbanks, Bethel, and Nome.

There is no set limit on loan size, percent of financing available (downpayment requirement) or collateral required. In fact, the major advantage of BIA loans is that they are designed to assist individuals who cannot meet the downpayment and collateral requirements of conventional lending sources. Another advantage is that interest rates are lower than many – but not all – conventional sources. The rate varies between relending associations, but is pegged between 1 percent and 2 percent above the federal discount rate. The discount rate over the last couple of years has ranged between 6.25 percent and 8 percent and is currently near 7 percent.

The payback period on BIA loans typically averages about ten years. Generally the larger the loan, the longer an individual has to repay. The BIA will lend for new construction, rehabilitation, repair or maintenance of a vessel, but prefers to stay away from working capital loans.

Commercial Banks

Banks are often the first stop for fishermen who are not eligible or cannot qualify for a State commercial fishing loan or a BIA loan. Being in the lending business they are capable of handling loans for all types of fishing and processing activities and all sizes of operations. Banks can also offer valuable management advice. Establishing a good working relationship with a bank can help lead to a successful fishing business.

Bank loan terms vary with the amount borrowed (or requested) and a host of other factors, including past fishing record, personal finances, and income potential of the new investment.

For loans up to $100,000 or $150,000 banks will generally finance 66 percent to 75 percent of the estimated value of new boat construction, or the survey value of a used boat. Payback period on loans in this size-category averages three years. For intermediate-size loans (in the $150,000 to $500,000 range), the level of financing can be expected to remain the same but the repayment period will vary between five and ten years, with seven years a typical figure. For large loans in the million dollar or more class, financing for up to 15 years is becoming available.

Banks' interest rates vary as we all know, but currently (September 1977) the rate for fishing vessels is around 10.25 percent.

For large loans of several hundred thousand dollars or more, some banks are willing to finance more than 75 percent of the project cost. But the interest rate on such loans can be expected to be higher as well.

Each fisherman seeking a bank loan of more than a few thousand dollars should be prepared to show a loan officer a detailed record of the last three to five years' income and expenses from fishing (tax records are a good source for this information), a financial statement of personal assets and liabilities, and a projection of expected income and expenses over several years from the new investment. These are commonly required by most lending organizations, including most of the loan sources listed in this article.

One final note about banks. Banks are competitive and no two loan officers operate exactly alike. Lending policies can vary from branch to branch of the same bank, and certainly between banks. So if you are seeking a loan and you can't get what you want from the first bank you walk into, don't give up. Shop around. Your luck could very well improve.

One way to substantially improve your chances of obtaining a loan is to qualify for a government guaranteed loan. The loan comes from the bank but the government guarantees payment in case you default. Read on!

Fishing Vessel Obligation Guarantee (FVOG)

This program is a real sleeper. Few fishermen or bankers are familiar with it, but it can be beneficial to both.

The system works this way. The federal government provides certain benefits to banks which in turn offer lowered interest rates to the fishermen. In some cases it can provide the opportunity for fishermen to get bank loan increases when this couldn't be done otherwise. Some of the benefits offered to your banker include:

1. No risk of loss. The government's guarantee is for 100 percent of the loan's principal and interest.

2. No paper work. The government provides credit and feasibility investigations, closing document preparation, and closing service.

3. No collateral servicing. The government holds and services all collateral in its name.

4. Guaranteed notes are classified as Type 1 investment securities. Banks can buy and sell them for their own account without limitation.

For the fisherman, it means that your bank should be able to offer an interest rate reduction somewhere between 1 and 2 percent below the conventional rate. To put this in more practical terms; on a

$100,000 loan over three years, a 1.5 percent interest rate reduction from 10.5 percent to 9 percent can mean a savings of close to $2,600.

If finding a lender, even with the aid of an obligation guarantee, is difficult, the National Marine Fisheries Service Financial Assistance Division (the office administering FVOG loans) will attempt to find a lender for you. They have developed a register of commercial, institutional and private investors across the country who are interested in lending money with the aid of a guarantee obligation.

The FVOG program will guarantee 75 percent of the financing or refinancing of construction, reconstruction, or reconditioning of a fishing vessel of five net tons or over. The obligation guarantee cannot be used for purchasing a used boat or for financing normal operating or repair and maintenance costs.

The guarantee will cover financing up to 15 years for newly constructed boats, and up to seven years for reconditioned or reconstructed vessels.

It would be prudent to allow about two months for processing an FVOG loan. The application procedure will include an application/investigation fee and an interview with a NMFS finance officer as well as the bank's loan department.

National Marine Fisheries Service charges a .75 percent annual guarantee fee on the unpaid principal during the life of the loan. In other words, if the bank drops its interest rate from 10.5 percent to 9 percent of the unpaid balance, the NMFS guarantee fee will move it back up to 9.75 percent. The program still provides an interest rate break as well as other financial advantages to the fisherman.

The first step in applying for a Fishing Vessel Obligation Guarantee is to contact the nearest NMFS financial assistance office. Alaskans and fishermen in Washington and Oregon should contact:

Jim Nickerson
1700 Westlake Avenue North
Seattle, Washington 98109
(206) 442-5532

Production Credit Associations (PCAs)

PCAs operate on a cooperative shareholder's system: for each $100 a fisherman wants to borrow, he much purchase $10 worth of stock in the association. In actuality the borrower winds up borrowing $110 for each $100 needed. Conversely, as the loan is paid off, shares are also retired so that the stock value remains at 10 percent of the unpaid principal value.

Presently the PCA will loan up to 60 percent of the estimated value on new vessel construction and 50 percent of the survey value of an existing vessel.

In addition, the PCA will loan the 10 percent necessary to purchase shareholder's stock. For example, on a $100,000 new construction project, a qualified fisherman may borrow $60,000 toward vessel construction plus $6,000 for shares in the association. The entire $66,000 will be charged the PCA's going interest rate.

The interest rate at the Portland PCA varies, but has remained below 8 percent for the past year. This very competitive rate is partially offset by the fact that a borrower normally must borrow the extra money to purchase stock and then pay interest on it. (Remember that the stock is also sold at the purchase price so nothing is gained or lost in the transaction.) However, with the added interest cost, the effective interest rate is still hard to beat. For example, with a simple interest rate of 7.75 percent on a vessel loan, plus an additional loan of 10 percent for shares, the effective interest rate becomes 7.75 percent + 0.775 percent = 8.525 percent. Still very competitive.

The maximum term of PCA loans is seven years with provisions to easily extend that to ten years. Legislation is presently being developed to allow PCAs to make 15-year loans.

Besides making loans for vessels, PCAs lend for general business operations, including equipment and family living requirements, and to persons furnishing services to fishermen which relate directly to operating needs – boatlifts, warehousing, and parts and repair facilities are examples.

There is no ceiling on loan size. Apply to:

J. E. Herberger, Manager
Northwest Livestock PCA
1212 Commonwealth Bldg.
Portland, Oregon 97204
(503) 222-1713

Federal Small Business Association (SBA)

Banks generally administer SBA loans, which can be used for financing boats which are *under* five net tons. The SBA loans are another form of a federal guarantee on money borrowed. The Small Business Administration will guarantee up to 90 percent of the loan offered by the bank.

Downpayments vary with each loan, but the SBA will allow the borrower to put down as little as 10 percent in some cases.

In order to be eligible for an SBA guarantee, a fisherman must first have applied for and been refused a loan from a bank. Without this rejection, a fisherman cannot apply for an SBA guarantee. A fisherman's inability to receive funding from a bank or from the NMFS's Fishing Vessel Obligation Guarantee program should be explained in detail and attached to his application for an SBA guarantee.

In some cases an SBA loan can be secured through the SBA itself, without dealing with a bank. This is a separate program from the SBA *guarantee* program. Securing loans directly from the SBA is very rare and should be attempted only when all other methods have failed.

Processors

One of the most common loan sources in the past has been fish processing companies. But with the trend toward expensive vessels, large cash needs to cover today's ex-vessel fish prices, and the advent of the State Commercial Fishing Loan program, the processors are generally easing out or simply getting out of the loan business.

For those fishermen seeking financing from processors who are willing to loan, there are two considerations to keep in mind.

First, the processor normally must borrow money from a bank or other lending source in order to lend to you. Consequently, the interest rate charged will be at least what the bank charges and perhaps more.

Second, the terms of the loan (such as collateral requirements, loan size, and repayment schedule) have traditionally been worked out on a one-to-one basis between plant managers and individual fishermen. They are usually dependent upon each fisherman's fishing background reliability in the eyes of the plant manager.

One more consideration. When a processor makes a loan to a fisherman it is generally understood that the fisherman will sell his catch to the processor. There are circumstances where this is not always possible, but it is generally expected.

Some processors who no longer make

(Continued on page 8)

NEWSNEWSNEWS

NPFMC

In its Tenth Plenary Session, September 22-24, the North Pacific Fishery Management Council met concurrently with its Scientific and Statistical Committee (SSC) and Advisory Panel (AP). In addition the SSC and AP met prior to the regular Council meeting. On September 22 the meeting included a public hearing. A closed session was held on September 23. In summary, highlights of the meeting were:

The Council approved the Tanner Crab Management Plan for the fishery off Alaska with the following specifications:

- Size limits for *Chionoecetes bairdi* were set at 5.5 inches (140mm) for the Bering Sea and the remainder of Alaska except for Prince William Sound, where a size limit of 5.3 inches (135mm) will continue. The Bering Sea area south of 58 degrees North latitude, and east of 164 degrees West longitude was closed to foreign crab fishing.
- The domestic annual harvest for the Bering Sea south of 58 degrees N and 164 degrees W will not exceed the allowable biological catch currently estimated at 78 million pounds.
- The present state regulations setting Cook Inlet and Prince William Sound as exclusive registration areas, and setting pot limits now in effect in southeastern Alaska areas were recommended for adoption as federal regulations.
- Recommended a foreign allowable catch (FAC) north of 58 degrees N latitude of 15,000 metric tons (33 million pounds).
- Specified procedures so the Regional Director of the National Marine Fisheries Service can open seasons based on specific parameters.

The Council approved the Gulf of Alaska Groundfish Fishery Plan with these specifications:

- A management regime was selected which allows protection of the halibut resource and rebuilding of stocks.
- The domestic groundfishery is encouraged to develop as rapidly as possible consistent with halibut protection.
- A method of monitoring the domestic groundifsh fishery has been developed whereby observers will determine if halibut comprise more than one percent of the catch in a month in any given statistical area. Should the catch of halibut exceed one percent in any area, that area will be closed to fishing.
- The question of trawl mesh size was deferred for one year.
- Joint venture activity was disapproved until July 1, 1978, at which time there will be a reevaluation of joint venture proposals and the state of development of the domestic groundfish fishery effort.
- Optimum yield (OY) for blackcod was set at 10,000 metric tons.
- The area east of 141 degrees W longitude was closed to foreign long lining.
- Foreign longlining will be allowed west of 157 degrees W inshore of the 500 meter isobath for true cod.
- Groundfish catches are to be apportioned by statistical areas in the Gulf of Alaska for both the U.S. and foreign fisheries.

The Council recommended that a 30 percent reserve of the OY be withheld for all species; the reserve to be reapportioned in mid year.

The Council directed that there be no foreign trawling in three sanctuary areas off the coast of Southeastern Alaska.

A report of the Halibut Working Group was accepted as an official Council document. A committee of five members was named to develop an official Council position on halibut.

The Council formally received the Draft Fishery Management Plan for the Commercial Troll Fisheries off the Coast of Alaska and ordered it forwarded for public comment and review. A series of public hearings is tentatively scheduled in December for Ketchikan, Sitka and Juneau, with the possibility of an additional hearing in Petersburg.

The Council heard a report on clam fishing in the Bering Sea and determined a controlled fishery is feasible. A production fishery based on previous experimental work may develop in 1978.

The Council's staff was directed to review foreign applications for permits to fish in the Fisheries Conservation Zone per guidelines to be developed by a Council sub-committee.

The Council approved the appointments of Don Rawlinson and John Jacobson as new members of the AP. A letter was directed to Hank Eaton and James Brooks commending them for service on the Council.

Harold Lokken (Seattle) was elected chairman for the coming year effective October 6. Clem Tillion (Alaska) was elected vice chairman.

The next meeting of the Council will be a combined November-December meeting to be held December 1-2 in the State Court Bldg., 3rd and K Streets, Anchorage.

AQUACULTURE NEWS BRIEFS

AQUACULTURE RETURNS NON-PROFIT HATCHERIES

The first returns of aquaculturally raised pink Alaskan salmon arrived at the Prince William Sound Aquaculture Corporation's (PWSAC) Port San Juan hatchery and the Sheldon Jackson College Aquaculture (Training) Program in Sitka. Both runs have exceeded expectations.

PWSAC had an estimated 5 percent return according to Wallace H. Noerenberg, Operations Manager, from a release of 1,000,000 fry. Sheldon Jackson had a return to the mouth of their hatchery creek of 5 to 6 percent from a

release of 1.6 million fry, according to Mel Seifert, Director of the Fisheries Program, Sheldon Jackson College.

PWSAC is expanding their hatchery to 25 million and Sheldon Jackson is expanding their hatchery to 10 million.

AQUACULTURE LOANS

Fish farmers are now eligible to apply for loans from the Small Business Administration. For further details contact the Marine Advisory Program at the address at the end of this column.

AMERICAN FISHERIES SOCIETY NATIONAL MEETING

A synopsis of the American Fisheries Society National Meeting held at Vancouver, B.C., September 14-17, is available from the Marine Advisory Program.

CANADIAN SALMONID DEVELOPMENT

The Canadian Federal Government has passed a bill authorizing $150 million for salmon projects in British Columbia. The money is to be spent over five years. More information on Canadian salmon projects will be presented in later issues of *Seas and Coasts.*

NATIONAL AQUACULTURE INFORMATION SYSTEM

Dr. James A. Lanier, Head of the National Aquaculture Information System, during his recent visit to our Anchorage office, has announced the formation of a computerized bibliographic file of over 2,500 books and articles on aquaculture. The file is a part of the NOAA Environmental Data Service's Oceanic and Atmospheric Science Information System (OASIS). The Aquaculture Information System was sponsored by the Office of Sea Grant.

To acquire or deposit general or specific information on aquaculture, contact me at:

Marine Advisory Program
University of Alaska
3211 Providence Drive
Anchorage, Alaska 99504
(Phone 278-4911)

– **Curt L. Kerns**
Aquaculture Advisory Specialist

DROWNING RESEARCH

ANN ARBOR – People, especially children, who have drowned in cold water aren't necessarily dead. Even if they have been under water for half an hour.

This is the conclusion of a new study by Dr. Martin S. Nemiroff, lung disease and diving medicine specialist from the University of Michigan.

Dr. Nemiroff studied nine drowning victims, who were submerged in cold water (under 70°F.) from four to thirty-eight minutes. They not only survived but suffered no brain damage. Submersion in cold water for longer than four minutes need not produce a human "vegetable."

Nemiroff states, "... 'Karen Quinlan syndrome' is not the inevitable consequence of oxygen deprivation – under cold water conditions."

How do these drowning victims survive with no brain damage?

According to Nemiroff, cold water sometimes activates the "mammalian diving reflex" which maintains life even after the victim becomes unconscious. This primitive reflex allows many water mammals (seals, porpoises and the like) to remain under water for long periods of time. The automatic reflex greatly reduces the blood supply to the skin, muscles and gut, tissues which are resistent to oxygen-loss damage. The remaining blood takes oxygen to the brain and, since the brain is cooled by submersion, it requires even less oxygen than normal.

The "mammalian diving reflex" is most likely to occur in children under three and a half years old and works for the victim even though he or she has all the appearances of death: no pulse or heartbeat; cold and blue skin; no breath; and fixed, dilated pupils.

Many factors are important for survival according to Nemiroff. Duration under water, the temperature of the water, the age of the victim and prompt, appropriate resuscitation efforts are all key elements.

Nemiroff is continuing his research with funding from the Michigan Sea Grant Program, a cooperative effort of the University of Michigan and Michigan State University. His most startling story of submersion and survival involves Brian Cunningham, a Jackson, Michigan, college student who was trapped in his car and submerged in an ice-covered pond for 38 minutes.

"The car rolled over after breaking through the ice, eliminating the possibility of an air bubble," Dr. Nemiroff said. "The patient recalled struggling, inhaling water, and losing consciousness."

When he and a companion were brought to the surface, both had no signs of life and were declared dead at the scene. When they were being loaded into an ambulance to be taken to the morgue, Cunningham gave an agonal gasp – a sort of involuntary belch often associated with death – and rescuers began resuscitation on him immediately. After two hours of resuscitation and 13 hours of respiratory support, Cunningham regained consciousness and recognized his mother. Two weeks later he left the hospital to return to college where he is an A- student.

The Cunningham case is spectacular. But the lessons are clear. The "mammalian diving reflex" can save some drowning victims.

Dr. Nemiroff's advice is, "Don't give up," especially if the victim is a child.

This research is of great significance to Alaska. Virtually all the lake, river, and coastal waters of the state are well below the 70°F. classified as "cold" water, according to scientists at the Institute of Water Resources at the University of Alaska. And, drowning is the second leading cause of accidental death in Alaska.

The University of Michigan Sea Grant Program and the U.S. Coast Guard are jointly developing a flyer giving first aid information for rescuers of cold water drowning victims. The flyer can be obtained from:

Communications Office
Michigan Sea Grant Program
2200 Bonisteel Blvd.
Ann Arbor, Maryland 48109

COMMERCIAL FISHING LOANS . . .

(Continued from Page 5)

direct loans will assist a fisherman in obtaining a loan from another source by guaranteeing the loan or a portion of it. As with direct loans, it is normally expected that the fisherman will sell his or her product to the processor guaranteeing the loan.

Getting It Together

It is not overdoing it to stress the importance of approaching a lender with a well prepared loan proposal. As pointed out by a lawyer working with fishermen in Oregon, "Getting a loan is somewhat of a sales problem and the product to be sold is the fisherman's ability to repay the money at a reasonable rate." The loan proposal should contain the information necessary for the lender to judge your ability to repay.

A complete loan proposal will include:

1. A resume containing references and a business experience summary pertaining to your fishing background.

2. A financial statement of present assets and liabilities.

3. Income and expense statements for the last three to five years fishing – income tax and catch records are good back-up for this.

4. Income and expense projections for the next three to five years using the new investment.

5. A detailed description of the proposed capital investment – a boat for example would include a description of the design features plus initial cost and operating costs.

6. Insurance information on the new investment.

In this article we have tried to explain what loan sources are available and what kind of information a lender needs to know. It is hoped that borrowing for your fishing business will be a less formidable and more successful enterprise.

Good luck and good fishing.

Dense Geoduck Beds Located

By Jon Rowley
Commercial Fisherman
Ketchikan, Alaska

A geoduck (gwē'duk) survey carried out by the private sector in the Ketchikan area has discovered beds as dense as those in Puget Sound, where five million pounds are harvested annually. Participating in the survey were Robert Earl of Norwest Undersea Harvesters; Del Hansen, Alaska Diving Service; Ketchikan resident Bill Baker; and Dennis Blankenbeckler, Alaska Department of Fish and Game. Norwest Undersea Harvesters is one of the primary geoduck processing companies in Puget Sound.

The geoduck is a large clam generally weighing around three pounds. Ketchikan diver Mick Nicholas reports bringing one in that weighed over twelve pounds. Although very unattractive in the shell, the body flesh has excellent flavor and texture according to Francois Kissel, chef and owner of the restaurant Brasserie Pitsbourg in Seattle, the first northwest restaurant to feature this clam as a menu item.

"It's a matter of getting people to try them," Kissel says. "Once a customer is adventurous enough to try the geoduck, he comes back for more. They are excellent." The tough large neck is usually ground for chowder.

The market for geoducks, buoyed by the depressed East Coast clam industry, is apparently quite strong and able to absorb twice the volume produced in Puget Sound. Norwest Undersea Harvesters market geoducks under the patented name of "King Clam Steak."

As the regulations are currently drafted, commercial utilization of geoducks in Alaska will require certification of geoduck beds by the State, or the development of a reliable on-site test for paralytic shellfish poisoning (PSP). PSP is presently detected by a mouse test which takes three days. Samples collected in the recent survey were shipped to the Northwest Fisheries Center in Seattle for testing.

A viable geoduck fishery is an attractive consideration in the Ketchikan area. The clam can be harvested at all times of the year providing year-round employment for divers and persons involved with processing and marketing. The clam will live three days out of water, which makes harvest in remote areas of Southeastern realistic.

According to Del Hansen of Alaska Diving Service, the group plans to continue surveys of the area. Actual harvest will depend on how quickly the State can formulate management concepts.

JAPANESE INVESTMENT . . .

(Continued from Page 2)

vessels documented for coastwide trade to United States citizens. In the Kyokuyo-Whitney case, for example, Whitney prior to Japanese takeover, was both an operator and preferred ship mortgage holder of vessels in U.S. coastwide trade. Therefore, prior to Kyokuyo's acquisition, Whitney was required to divest its assets and liabilities in U.S. vessels.

These U.S. federal regulations that tend to direct foreign ownership toward seafood processing rather than domestic fishing operations differ significantly from the Japanese regulations pertaining to this issue. Presently, the Japanese Ministry of International Trade and Industry and the Ministry of Finance will not grant foreign investment approval for foreign investments in fisheries governed by international fishing treaties. Therefore, since most NEP fisheries actually are governed by bilateral treaties with Japan, this regulation may have hampered Japanese investors in directing their efforts toward NEP fishing operations. Instead they concentrated on land-based processing establishments.

The NEP seafood processors, at least during the 60s, were also the natural investment target for the Japanese fishery and trading companies. During this period the Japanese investors were interested in specialty products, which were primarily by-products from the processing line rather than raw products from the fishermen. However, as the Japanese demand for fishery products increases, vertical integration, particularly by the major fishery companies, may become a reality. One company is committing some $40 million over the next five years in strengthening their operations in the NEP.

If the Japanese are to intensify their investments in the NEP, this may severely alter their low political profile in the region. The fairly tranquil period of the past may soon expire as the Japanese investments reach the similar "peril point" experienced in a number of Far Eastern countries. According to Dr. Ichimura, Director of the Southeast Asia Research Center in Japan, the "peril point," with subsequent anti-Japanese sentiments, arises in the host country when Japanese investors exceed one-third financial ownership of the local industry.

The "peril point" in the entire NEP seafood processing industry may still be far in the future. However, certain point

concentrations, such as Kodiak, the largest fishing port in the NEP, have already caused some negative sentiments toward foreign investments. In fact, the National Marine Fisheries Service published a report this year concerned with the potential Japanese control of the tanner crab market. Although the report concluded that the Japanese did not control that specific market, a concern over the effect of Japanese investment has nevertheless surfaced.

In the next issue of Alaska Seas and Coasts *the author examines foreign investment in the Alaskan fishing industry since the advent of the 200-mile limit.*

SELECTED REFERENCES

Alaska Division of Economic Enterprise. 1974. *Japanese Investment in Alaska.* Department of Economic Development. pp. 14-15.

Alaska Sea Grant Program. 1977. *Ownership and Location of Tanner Crab Processing Companies Operating in Alaska,* University of Alaska, Fairbanks.

Foreign Ownership in the Seafood Processing Industry, Juneau. Legislative Affairs Agency. 1977. Appendix A.

Capital Investment by Japanese Firms in Alaska Seafood Industry. 1975. United States Embassy, Tokyo. pp. 1-3.

Economic and Marketing Research Division, *Foreign Direct Investment in the U. S. Commercial Fisheries Industry,* (Washington, D.C.: National Marine Fisheries Service, 1976). Appendix A.

Sullivan, Jeremiah J. 1976. *Pacific Basin Enterprise and the Changing Law of the Sea.* Pacific Rim Project No. 2, University of Washington, Seattle. pp. 273-275 (Table 42).

Olsen, Ken. 1977. *Foreign Capital Investments in U.S. Seafood Industry* (Seattle: Alaska Fishermen's Union, Seattle. pp. 1-2.

Overseas Investment and Joint Ventures by the Japanese Fishing Industry. 1977. Fisheries Yearbook (Suisan Nenkan 52). pp. 163-179.

United States – Japan Joint Investment in Fishing Companies. Tokyo: Fisheries Yearbook 1975. pp. 174. (Suisan Nenkan 50).

JAPANESE INVESTMENT IN THE NORTHEAST PACIFIC (NEP)

JAPANESE INVESTORS	U. S. SUBSIDIARIES	DATE OF INVESTMENT	EQUITY (CAPITAL STOCK)	
			PERCENT	$1,000 (U.S.)
Taiyo	Pacific Alaska Fisheries	12/65	49	50
	B & B Fisheries	-/67	70	305
	Western Alaska Enterp.	11/67	100	550
	B & B Fisheries	-/74	30	131
	NEP TOTAL			1036
Nichiro Mitsubishi	Orca Pacific	6/66	50	1000
	Hilton Seafood	7/73	50	81
	Sand Point Packing	------	50	
Nichiro	Nichiro Pacific	8/67	100	300
	Adak Aleutian Proc.	6/73	30	33
	NEP TOTAL			333
Marubeni	North Pacific Proc.	6/72	50	250
	Marubeni Alaska Seaf.	6/72	100	600
	Bering Sea Fisheries	6/72	25	135
	Juneau Cold Storage	4/73	25	25
	King Crab, Inc.	4/73	49.9	1500
	Kodiak Fishing Co.	4/73	25	130
	Ward Cove Pack.	11/73		
	Juneau Fishing Co.	11/73		
	Alaska Ice & Storage		100	
	Alaska Pacific Seaf.		100	100
	Columbia-Ward Fish.		25	
	Cordova Bay Fisheries		50	
	New Eng.-Marub. Export			
	New Eng.-Marub. Seaf.			
	Point Chehalis Packers			
	St. Elias Ocean Products			
	Togiak Fisheries		49.9	256
Nippon-Suisan Mitsui	Morpac	6/73	37.6	405
	Morpac	-/76	60	646
	NEP TOTAL			1051
Nippon-Suisan	Universal Seafood	6/74	49.9	
	Intersea Fisheries	3/75	40	
	Dutch Harbor Seafood		25	
	Nippon Suisan (USA)		100	300
Kyokuyo	Kyokuyo (USA)	-/73	100	300
	Whitney Fidalgo	10/73	97.9	11,000
	Mokuhana Fisheries (M/V)			
	Nefco-Fidalgo Packing		50	
C.Itoh Hokuyo	New Northern Proc.	3/74	50	500
C. Itoh	Roy Furfjord			
Iwakiri Fisheries	Alaska Marine Prod.	-/74		
Ak. Pulp Co.	Harbor Seafoods		100	
Alaska Shokai	JAD Alaska Shoji			
Kyodo Kumiai	JCT Alaska	6/73	100	10
Kenai Fisheries	R. Lee Seafoods		20	
Kamai Fisheries	William Sound Fisheries			

Wheel Watch

Readers of **Alaska Seas and Coasts** *often encounter issues affecting the fishing industry at large. WHEEL WATCH is available to you, the reader, to present short factual articles on topics of concern, along with your views of the consequences. Opinions expressed are those of the author, and not necessarily those of the University of Alaska. Submissions should be limited to two double-spaced, typewritten pages.*

– Ed.

MINE THREATENS SOUTHEAST SALMON RUN

By Jon Rowley
Commercial Fisherman
Ketchikan, Alaska

As salmon fishermen in southern S.E. Alaska assess themselves 3 percent to stabilize and enhance the fishery through a regional hatchery program, a huge open-pit molybdenum mine is being planned that would inevitably wreak havoc with as many as three prime salmon producing rivers. If the hatchery program is quite successful, area fishermen could break even.

U.S. Borax and Chemical Corp., a subsidiary of the multinational Rio Tinto Zinc, has announced intentions of developing a substantial molybdenum ore deposit at Quartz Hill on the divide of the Wilson-Blossom and Keta Rivers. The combined drainages produce up to 1.5 million pink salmon annually as well as commercially significant numbers of chum, red, coho, and king salmon. The Wilson, Blossom, and Keta account for three of the 17 king salmon spawning rivers in Southeastern.

PRESENT STATUS

The present status of the mine, surrounded by many questions and public confusion, resembles a ping pong game with 12 players and three balls in the air at once, as political maneuvering takes place between the Forest Service, U.S. Borax, the Governor's office, various state agencies, EPA, CEQ, the U.S. House and Senate Interior Committees, Ketchikan municipal government, labor, local and national conservation groups, and fishermen. Spokesmen for fisheries values are a decided minority in this formidable arena.

The Quartz Hill site is located within the boundaries of the proposed Misty Fiords Wilderness Area as described in the Udall (HR 39) and Metcalf (S 1500) bills. The company has stated they would abandon the project if the area is designated wilderness.

Under current mining laws U.S. Borax cannot be denied "reasonable access" to their claims. Part of the controversy centers on just what constitutes "reasonable access." The company claims they cannot proceed with actual mine development until the extent of the ore body is verified by deep drilling and ore content is verified by bulk sampling. Therefore, they requested a permit from the U.S. Forest Service to build a 13-mile access road along the Keta River to the site. The road, according to U.S. Borax, is needed to transport heavy drilling equipment and bulk ore samples. The road would eliminate some spawning gravel, impact resting pools and rearing areas, and subject a naturally unstable area to sediment producing slides.

The draft Environmental Impact Statement (EIS) on the access road drew heavy fire. Fishermen and conservationists insisted that helicopter access, which was not addressed, is economically practical, would satisfy the legal requirements of "reasonable access." Further, it would not jeopardize the fisheries values and wilderness qualities of the Keta drainage.

Many, including former Commissioner of the Alaska Department of Fish and Game (ADF&G), James Brooks, also felt that the overall impact of the eventual mine should have been addressed in the impact statement.

MAJOR PROBLEM

The most serious problem with open-pit mining is disposal of tailings. The Borax mine will produce approximately 30,000 tons of chemically treated, finely powdered tailings a day. ADF&G has gone on record as being "unalterably opposed" to ocean dumping. Needed then is an enormous reservoir able to receive 30,000 tons per day for 20 to 30 years, the expected life of the mine.

Tailings will be piped into the tailings pond in the form of toxic slurry. As the solids settle, the poisonous water has no where to go except over the lip of the pond and into the river drainage. Over 150 inches of annual precipitation will seriously aggravate the problem. Leachates from the chemically treated tailings, if not contained, could destroy the productive salmon habitat of the effected drainages.

Additionally, several million gallons of water will be required in the three-phase chemical flotation process. The water source has not been named.

FINAL EIS

The final EIS on the access road has been released and shows a comparable cost of helicopter and road access. South Tongass Forest Supervisor, James Watson, will soon decide whether to issue the company a road permit or to require them to continue exploration activities via helicopter. If Watson decides to issue the road permit, fishermen and conservationists may make an administrative appeal. If an administrative appeal fails, parties may seek adjudication.

An article, "The Killing of a Wild River," by Doyle Kline in the September 1977 issue of *Field and Stream* describes the devastating impact of an open-pit molybdenum mine on the Red River in Questa, New Mexico. The U.S. Borax mine issue could well boil down to a choice of salmon or molybdenum.

The U.S. Borax project could be just the beginning of problems for Southeastern fishermen. Nearly 350 other firms, including American Oil Company, Cotter Corporation, Exxon, and Gulf Oil have filed mineral claims in southern Southeast Alaska.

NEW COAST GUARD SANITATION REGS

By Craig Wiese
Marine Advisory Program
Cordova, Alaska

Environmental Protection Agency (EPA) regulations governing the discharge of vessel sewage in coastal marine and fresh waters became effective in January of this year. The regulations cover virtually all vessels with toilet facilities installed on board.

Essentially, the regulations require treatment of vessel sewage with a Coast Guard certified treatment unit. The Coast Guard uses the term "marine sanitation device."

The regulations do not apply to vessels with portable equipment (carry on and off), nor do they require the installation of toilet facilities on vessels which do not already have them.

The timetable for compliance with the regulations is different for "new vessels" (keel laid on or before January 30, 1975) and "existing vessels" (keel laid before January 30, 1975). There is also a difference in the level of treatment required. Generally, the longer you put it off, the more sophisticated and expensive the treatment unit will be.

The regulations basically read like this:

A. For "existing" vessels:

1. A vessel owner has until January 30, 1980 to install a treatment unit.
2. However, the EPA has offered an incentive for earlier installation. If a Coast Guard certified treatment unit providing the minimum required treatment (1000 fecal coliform per 100 million parts of water and no "visible floating solids") is installed before January 30, 1978, it will never have to be replaced by a unit providing better treatment as long as it remains operable.
3. A treatment unit installed on or after January 30, 1980 will be required to provide a higher degree of treatment.

B. For "new" vessels:

1. As of January 30, 1977 all vessels constructed on or after January 30, 1975 must have a Coast Guard certified treatment unit installed providing the minimum required treatment. In other words, any vessel constructed between January 1975 and now should have a treatment device installed.
2. Vessels constructed on or after January 30, 1980 will require equipment providing a higher level of treatment.

Most treatment units presently on the market are Coast Guard certified although you should be certain that the label states Coast Guard certification and gives a certification number.

Owners of "existing" vessels that had treatment units installed before 1976 should check with the Coast Guard to learn if the units are certified.

For more details, write to your local Coast Guard center. Ask for publication number CG-485, titled "Federal Marine Sanitation Device Regulations."

Charts of the Bering Sea Fish and Shellfish Resources

During August-October 1975, and April-June 1976, the National Marine Fisheries Service conducted extensive demersal trawl surveys of the eastern Bering Sea. The results of these two surveys are now available as data sheets that overlay National Ocean Survey Chart No. 16006, showing catch rates (weight per distance towed) at each trawling station.

The data sheets provide a comprehensive picture of the distribution and relative abundance of each resource within the area 54-61° N latitude, 156-176° W longitude. All persons within the fishing industry who have use for this information are invited to submit requests.

If you wish to obtain the charts, fill out, clip, and mail the form below.

Please send the charts indicated below:

	1975 SURVEY (538 stations)	1976 SURVEY (479 stations)
FISH		
Total Groundfish	[ ]	[ ]
Walleye Pollock	[ ]	[ ]
Pacific Cod	[ ]	[ ]
Yellowfin Sole	[ ]	[ ]
Pacific Halibut	[ ]	[ ]
SHELLFISH		
Red King Crab	[ ]	[ ]
Blue King Crab	[ ]	[ ]
Total Tanner Crab	[ ]	[ ]
Tanner Crab *(C. bairdi)*	[ ]	[ ]
Tanner Crab *(C. opilio)*	[ ]	[ ]

Name: _____

Address: _____

City: _____ State: _____ Zip: _____

Mail to: **Bering Sea Project**
Resource Assessment Division
Northwest and Alaska Fisheries Center
2725 Montlake Boulevard East
Seattle, Washington 98112

Safety Standards Available

By Jchn L. Ball
Marine Advisory Program
University of Alaska

The *Interim Fishing Vessel Safety Standards* have just been printed. This booklet contains fishing vessel safety standards that have been developed by Alaskan fishermen over the past six years. They are intended to be used as a guideline for increased safety in areas of construction, equipment, maintenance, personnel, and operations while fishing.

It is expected that as these standards are implemented by the fishing fleet a reduction in loss of life, injury, casualty, and loss of vessels will occur. At the same time this will help to lower insurance costs to the vessel owner.

Single free copies may be obtained by writing to:

Alaska Sea Grant Program
University of Alaska
Fairbanks, Alaska 99701

Bulk quantities are available at cost by writing to the same address.

Alaska's harsh environment takes an annual toll of fishing vessels and lives. In an effort to minimize these losses, fishermen – the most qualified persons to evaluate the problem – have evolved a set of safety standards for operators in the Gulf of Alaska and the Bering Sea. The University of Alaska Sea Grant Program is pleased to make these standards available to the fishing industry.

(Photo by Norman Holm, Kodiak Marine Surveyors)

ALASKA Seas and Coasts

UNIVERSITY OF ALASKA
ALASKA SEA GRANT PROGRAM
FAIRBANKS, ALASKA 99701

Nonprofit Organization
Bulk Rate
Permit No. 2
Fairbanks, AK 99701

The University of Alaska Sea Grant Program is made possible through a grant from the National Oceanic and Atmospheric Administration, U.S. Department of Commerce. **ALASKA Seas and Coasts** is published by the University of Alaska Sea Grant Program, Donald H. Rosenberg, Director. Free subscriptions are available upon written request. Address all inquiries to the Editor, **ALASKA Seas and Coasts**, University of Alaska, Fairbanks, AK 99701.

October 27, 1977

Jim Kelly, Editor
University Reporter
University of Alaska
2533 Providence
Anchorage, AK 99504

Dear Editor:

Ken Pergola's September 20 article on the Permanent Fund was well written. I hope the University Reporter continues to cover the Permanent Fund developments and other statewide issues.

The title of the article (as well as some of the symposium debate), "How Would You Spend $2 Billion" may have been somewhat misleading in that the Alaska constitution requires that all Permanent Fund monies be placed in "income producing investments" and the word "permanent" at least raises the strong presumption that the Fund will not be spent but managed so as to preserve the capital or principal of the Fund.

There is general agreement that "income producing investments" means using the Fund in a way which not only preserves the capital assets of the Fund but will also return direct earnings on those capital assets.

However, the income or earnings from the required investments, as Mr. Pergola points out, may be used in any manner the legislature directs, regardless of whether the use or spending of the income results in any direct earnings or monetary return to the Permanent or General Funds.

So far the debate on how the principal of the Fund (the $1.5 to 2.0 billion estimated to accumulate in the Fund by 1985) should be invested has revolved mainly around whether the Fund should be primarily a "savings trust" as opposed to a "development bank."

The debate continues and the Committee will have its next public meeting in Anchorage, State Court Building, Room 402, 303 K Street at 1:30 p.m., November 18, and 9:00 a.m., November 19 to take action on some proposals for structuring the Fund.

The continued interest of the University community and the University Reporter is very much welcome.

Cordially,

Clark Gruening

Clark Gruening
Chairman
House Special Committee on
The Alaska Permanent Fund

September 29, 1977

Scott Goldsmith
Institute of Social & Economic
Research
University of Alaska
707 A Street
Anchorage, AK 99501

Scott:

Here's Barker's analysis, as we discussed on the telephone.

Sincerely,

Mike

Mike Doogan
Administrative Assistant

MD:LAD

Enclosure

31-Q1LH

STATE OF ALASKA

THE LEGISLATURE

BUDGET AND AUDIT COMMITTEE

AUDIT DIVISION
POUCH W—ALASKA OFFICE BUILDING

FINANCE DIVISION
POUCH WF—STATE CAPITOL

JUNEAU 99801

M E M O R A N D U M

TO: Honorable Clark Gruening
Chairman
House Permanent Fund Committee

DATE: September 22, 1977

FROM: Milt Barker MB
Fiscal Analyst
Legislative Finance

SUBJ: Permanent & General Fund Projections

At your request, I am enclosing six computer scenarios which display projected budget surpluses or deficits, followed by end-of-year permanent fund and general fund balances, and finally a column entitled "revenue required for general fund balance of $0 million". This last column may also be interpreted as the required reduction in expenditures for a zero general fund balance.

However, visualizing it as additional required revenue, Table 1 was developed. In this table, the required permanent fund balance is determined by dividing the required revenue from the computer report by .07, the earnings rate on the permanent fund, to find the additional fund principal required to produce this revenue, and adding that to the projected balance. However, in those cases where 50% of the permanent fund earnings go to Alaska, Inc., the additional required principal will be twice as large.

The required Alaskan economy in terms of personal income to continue funding the budget is determined by dividing the additional required revenue by .079 and adding this additional personal income base required to the projected base shown on Table 1. The projected base was determined by dividing "other revenue" shown in the assumptions by .079; "other revenue" consists of all unrestricted revenue less severance taxes, property taxes, state and federal resource revenue, and Prudhoe income taxes. In other words, all those items which may relate somewhat to personal income. In FY 76, "other revenue" was roughly $286.1 million which was 7.9% of the FY 76 personal income of $3.6 billion.

The first scenario is a best guess of what will be with no statutory changes. It assumes 25% of royalty goes to the permanent fund and 5% to the renewable resources fund. Conceivably, the 5% could stop once $250 million is reached. In all scenarios 2% of royalty goes to native claims until $500 million is reached. The required general fund balance of $0 million assumes the sale, transfer to the permanent fund, or liquidation of the state's unmarketable loan portfolio; this is one assumption you might want changed.

Scenario 2 adds Alaska Inc. at 50% of permanent fund earnings which moves forward the date of insolvency by one year. However, increasing the royalty contribution to 50% moves insolvency forward five years as in Scenario 3. If the rate were then cut back to 30%, the permanent fund would stand $489.3 million higher in 1982, providing an additional $17 million a year in revenue after deducting Alaska, Inc. Looking back to Scenario 2, it is clear that this will not cover the projected deficits beyond 1982. With 100% of royalties put in the permanent fund, as in Scenario 3A, the situation only gets worse.

As long as deficits or borderline surpluses are envisioned, it makes no sense to sock away a greater proportion of royalties, since in the mid-term at budget growth rates of 15%, we are relying on royalties to fund such budgets. If we could hold budget growth to some lower level, a greater proportion of royalties could be put in the permanent fund, thus reducing deficits in the long run when oil revenue halts.

A lower growth rate than 15% may be necessary anyway since, as table one indicates, the required permanent fund, or Alaskan economy given the present tax structure, to sustain such growth appears unrealistic. Yet, the compound growth rate from FY 68's general fund appropriation of $103 million to FY 78'3 of $819 million has been 23% per annum.

Scenarios 4 and 5 allow none of the permanent fund earnings to be used to support the budget, 4 by retaining all earnings in the permanent fund, 5 by paying all earnings to Alaska, Inc. Of course, the idea with 4 would be at some point to begin putting the earnings back in the general fund. If this is done at the point at which the general fund balance reaches zero, scenario 4 is then essentially the same as scenario 1, except that earnings and surplus are carried in the permanent fund rather than the general fund and, as a consequence of locking up these amounts, the general fund reaches zero a little sooner.

Scenario 6 retains 10% of the budget appropriation in the general fund balance where surpluses permit, all the rest of the general fund balance being transferred to the permanent fund. If you would rather the program maintain the general fund balance at the specified percentage of budget, regardless of surpluses or deficits, showing the additional revenue required to do so, this modification could be made.

Please let me know if you desire any additional scenarios using different assumptions.

MB:bf

STATE OF ALASKA
LEGISLATIVE FINANCE WORKING DOCUMENT
BUDGET FORCASTING MODEL

1

21-SEP-77

COMMENTS
ALCAN
TAPS BUILDUP RESUMES MARCH 78
MEDIUM REVENUES (HAGGART CASE II)

ASSUMPTIONS
ANNUAL RATE OF INTEREST ON GENERAL + PERMANENT FUNDS = 7.00%
% OF CURRENT YEAR EXPEND. IN G.F. CASH BAL = 20.00%
% OF ROYALTIES LEASES AND BONUSES DEPOSITED IN PERMANENT FUND = 30.00%
ANNUAL % INCREASE IN BUDGET APPROPRIATION = 15.00%

YEAR END	NON INVESTMENT REVENUE	INVESTMENT INTEREST	TOTAL REVENUE	BUDGET APPROPRIATION	SUPPLE-MENTALS	DEBT SERVICE	PAYMENTS TO FUNDS	TOTAL EXPENDITURE	SURPLUS OR DEFICIT	PERM-ANENT FUND	GENERAL FUND END OF YEAR	REVENUE REQ FOR GF BAL.
1977										4.0	652.7	
1978	794.0	56.4	850.4	853.8	0.0	0.0	119.0	972.8	-122.5	81.6	530.2	0.0
1979	1100.6	60.3	1161.1	981.9	0.0	0.0	206.9	1188.8	-27.7	216.6	502.6	0.0
1980	1269.1	70.7	1339.8	1129.2	0.0	0.0	237.8	1367.0	-27.2	374.9	475.4	0.0
1981	1523.2	67.7	1670.9	1298.5	0.0	0.0	261.4	1559.9	110.9	548.5	586.3	0.0
1982	1745.4	109.7	1855.1	1493.3	0.0	0.0	283.9	1777.2	78.0	738.0	664.3	0.0
1983	1925.9	130.2	2056.1	1717.3	0.0	0.0	327.6	2044.9	11.2	954.4	675.5	0.0
1984	2069.7	150.1	2219.8	1974.9	0.0	0.0	242.5	2217.4	2.4	1189.9	677.9	0.0
1985	2251.2	167.7	2418.9	2271.1	0.0	0.0	254.9	2526.0	-107.1	1444.8	570.8	0.0
1986	2403.9	176.6	2580.5	2611.8	0.0	0.0	274.5	2886.3	-305.8	1719.3	264.9	0.0
1987	2563.4	182.0	2745.4	3003.6	0.0	0.0	295.1	3298.7	-553.3	2014.4	-0.0	288.3
1988	2732.3	200.5	2932.8	3454.1	0.0	0.0	316.7	3770.8	-838.1	2331.1	-0.0	838.1
1989	2910.2	230.7	3140.9	3972.2	0.0	0.0	339.4	4311.6	-1170.7	2670.5	-0.0	1170.7
1990	3096.9	263.6	3360.4	4568.0	0.0	0.0	363.3	4931.3	-1570.9	3033.8	-0.0	1570.9

STATE OF ALASKA
LEGISLATIVE FINANCE WORKING DOCUMENT
BUDGET FORCASTING MODEL

2

21-SEP-77

COMMENTS
ALCAN
TAPS BUILDUP RESUMES MARCH 78
MEDIUM REVENUES (HAGGART CASE II)

ASSUMPTIONS
ANNUAL RATE OF INTEREST ON GENERAL + PERMANENT FUNDS = 7.00%
% OF CURRENT YEAR EXPEND. IN G.F. CASH BAL = 20.00%
% OF ROYALTIES LEASES AND BONUSES DEPOSITED IN PERMANENT FUND = 30.00%
ANNUAL % INCREASE IN BUDGET APPROPRIATION = 15.00%
% OF PERMANENT FUND EARNINGS TO ALASKA INC = 50.00%

YEAR END	NON INVESTMENT REVENUE	INVESTMENT INTEREST	TOTAL REVENUE	BUDGET APPROPRIATION	SUPPLE-MENTALS	DEBT SERVICE	PAYMENTS TO FUNDS	TOTAL EXPENDITURE	SURPLUS OR DEFICIT	PERM-ANENT FUND	GENERAL FUND END OF YEAR	REVENUE REQ FOR GF BAL OF $0 MIL
1977										4.0	652.7	
1978	794.0	56.3	850.3	853.8	0.0	0.0	120.5	974.3	-124.0	81.6	528.7	0.0
1979	1100.8	60.0	1160.8	981.9	0.0	0.0	212.2	1194.0	-33.2	216.6	495.5	0.0
1980	1269.1	69.8	1338.9	1129.2	0.0	0.0	248.2	1377.3	-38.4	374.9	457.1	0.0
1981	1583.2	85.7	1668.9	1298.5	0.0	0.0	277.6	1576.1	92.9	548.5	550.0	0.0
1982	1745.4	106.2	1851.6	1493.3	0.0	0.0	306.4	1799.7	52.0	738.0	601.9	0.0
1983	1925.9	124.6	2050.5	1717.3	0.0	0.0	357.2	2074.5	-24.0	954.4	577.9	0.0
1984	2069.7	141.6	2211.3	1974.9	0.0	0.0	280.0	2254.9	-43.6	1189.9	534.4	0.0
1985	2251.2	155.6	2406.8	2271.1	0.0	0.0	301.0	2572.1	-165.3	1444.8	369.0	0.0
1986	2403.9	160.2	2564.1	2611.8	0.0	0.0	329.9	2941.7	-377.5	1719.3	0.0	8.5
1987	2563.4	172.7	2736.1	3003.6	0.0	0.0	360.5	3364.0	-627.9	2014.4	0.0	627.9
1988	2732.3	200.5	2932.8	3454.1	0.0	0.0	392.8	3846.9	-914.1	2331.1	0.0	914.1
1989	2910.2	230.7	3140.9	3972.2	0.0	0.0	426.9	4399.1	-1258.2	2670.5	0.0	1258.2
1990	3096.8	263.6	3360.4	4568.0	0.0	0.0	463.1	5031.1	-1670.7	3033.8	0.0	1670.7

STATE OF ALASKA
LEGISLATIVE FINANCE WORKING DOCUMENT
BUDGET FORCASTING MODEL

3

21-SEP-77

COMMENTS
ALCAN
TAPS BUILDUP RESUMES MARCH 78
MEDIUM REVENUES (HAGGART CASE II)

ASSUMPTIONS
ANNUAL RATE OF INTEREST ON GENERAL + PERMANENT FUNDS = 7.00%
% OF CURRENT YEAR EXPEND. IN G.F. CASH BAL = 20.00%
% OF ROYALTIES LEASES AND BONUSES DEPOSITED IN PERMANENT FUND = 50.00%
ANNUAL % INCREASE IN BUDGET APPROPRIATION = 15.00%
% OF PERMANENT FUND EARNINGS TO ALASKA INC = 50.00%

YEAR END	NON INVESTMENT REVENUE	INVESTMENT INTEREST	TOTAL REVENUE	BUDGET APPROPRIATION	SUPPLEMENTALS	DEBT SERVICE	PAYMENTS TO FUNDS	TOTAL EXPENDITURE	SURPLUS OR DEFICIT	PERMANENT FUND	GENERAL FUND END OF YEAR	REVENUE REQ FOR GF BAL SG MIL
1977										4.0	652.7	
1978	794.0	56.3	850.3	853.8	0.0	0.0	173.2	1027.0	-176.7	133.4	476.0	0.0
1979	1100.8	59.8	1160.6	981.9	0.0	0.0	305.5	1287.4	-126.7	356.3	349.3	0.0
1980	1269.1	69.3	1338.4	1129.2	0.0	0.0	360.6	1489.7	-151.3	622.2	197.9	0.0
1981	1583.2	84.5	1667.7	1298.5	0.0	0.0	404.0	1702.5	-34.8	911.5	163.1	0.0
1982	1745.4	104.0	1849.4	1493.3	0.0	0.0	447.6	1940.9	-91.5	1227.3	71.6	0.0
1983	1925.9	125.1	2051.0	1717.3	0.0	0.0	521.2	2238.5	-187.5	1588.1	-0.0	115.9
1984	2069.7	152.5	2222.2	1974.9	0.0	0.0	461.9	2436.8	-214.5	1980.5	0.0	214.5
1985	2251.2	185.3	2436.5	2271.1	0.0	0.0	501.6	2772.7	-336.2	2405.4	0.0	336.2
1986	2403.9	221.0	2624.9	2611.8	0.0	0.0	549.7	3161.5	-536.6	2862.9	0.0	536.6
1987	2563.4	259.7	2823.1	3003.6	0.0	0.0	600.7	3604.2	-781.2	3354.7	0.0	781.2
1988	2732.3	301.7	3034.0	3454.1	0.0	0.0	654.5	4108.6	-1074.6	3882.6	0.0	1074.6
1989	2910.2	347.2	3257.4	3972.2	0.0	0.0	711.4	4683.6	-1426.2	4448.2	-0.0	1426.2
1990	3096.8	396.5	3493.3	4568.0	0.0	0.0	771.7	5339.8	-1846.5	5053.6	-0.0	1846.5

STATE OF ALASKA
LEGISLATIVE FINANCE WORKING DOCUMENT
BUDGET FORCASTING MODEL

14

22-SEP-77

COMMENTS
ALCAN
TAPS BUILDUP RESUMES MARCH 78
MEDIUM REVENUES (HAGGART CASE II)

ASSUMPTIONS
ANNUAL RATE OF INTEREST ON GENERAL + PERMANENT FUNDS = 7.00%
% OF CURRENT YEAR EXPEND. IN G.F. CASH BAL = 20.00%
% OF ROYALTIES LEASES AND BONUSES DEPOSITED IN PERMANENT FUND = % 100 %
ANNUAL % INCREASE IN BUDGET APPROPRIATION = 15.00%
% OF PERMANENT FUND EARNINGS TO ALASKA INC = 50.00%

YEAR END	NON INVESTMENT REVENUE	INVESTMENT INTEREST	TOTAL REVENUE	BUDGET APPROPRIATION	SUPPLE-MENTALS	DEBT SERVICE	PAYMENTS TO FUNDS	TOTAL EXPENDITURE	SURPLUS OR DEFICIT	PERM-ANENT FUND	GENERAL FUND END OF YEAR	REVENUE REQ FOR GF BAL OF $0 MIL
1977										4.0	552.7	
1978	794.0	56.2	850.2	853.8	0.0	0.0	304.8	1158.6	-308.4	262.7	344.3	0.0
1979	1100.8	59.9	1160.7	981.9	0.0	0.0	538.9	1520.7	-360.0	712.5	-0.0	15.7
1980	1269.1	84.2	1353.3	1129.2	0.0	0.0	641.5	1770.6	-417.4	1240.3	-0.0	417.4
1981	1583.2	125.3	1708.5	1298.5	0.0	0.0	720.0	2018.6	-310.1	1819.0	-0.0	310.1
1982	1745.4	170.3	1915.7	1493.3	0.0	0.0	800.6	2293.9	-378.2	2450.5	-0.0	378.2
1983	1925.9	220.8	2146.7	1717.3	0.0	0.0	931.1	2648.4	-501.7	3172.1	-0.0	501.7
1984	2069.7	277.2	2346.9	1974.9	0.0	0.0	916.7	2891.6	-544.7	3957.0	-0.0	544.7
1985	2251.2	338.5	2589.7	2271.1	0.0	0.0	1003.1	3274.2	-684.5	4806.7	-0.0	684.5
1986	2403.9	405.1	2809.0	2611.6	0.0	0.0	1099.2	3711.0	-902.1	5721.7	-0.0	902.1
1987	2563.4	477.0	3040.4	3003.6	0.0	0.0	1201.2	4204.7	-1164.3	6705.4	-0.0	1164.3
1988	2732.3	554.7	3287.0	3454.1	0.0	0.0	1308.9	4763.0	-1476.0	7761.1	-0.0	1476.0
1989	2910.2	638.5	3548.7	3972.2	0.0	0.0	1422.6	5394.8	-1846.2	8892.3	0.0	1846.2
1990	3096.8	728.8	3825.6	4568.0	0.0	0.0	1543.3	6111.4	-2285.8	10103.2	0.0	2285.8

STATE OF ALASKA
LEGISLATIVE FINANCE WORKING DOCUMENT
BUDGET FORCASTING MODEL

4

21-SEP-77

COMMENTS
ALCAN
TAPS BUILDUP RESUVES MARCH 78
MEDIUM REVENUES (HAGGART CASE II)

ASSUMPTIONS
ANNUAL RATE OF INTEREST ON GENERAL + PERMANENT FUNDS = 7.00%
% OF CURRENT YEAR EXPEND. IN G.F. CASH BAL = 20.00%
% OF ROYALTIES LEASES AND BONUSES DEPOSITED IN PERMANENT FUND = 30.00%
ANNUAL % INCREASE IN BUDGET APPROPRIATION = 15.00%
% OF EARNING RETAINED IN PERMANENT FUND = % 100 %
% OF SURPLUS TO PERMANENT FUND = % 100 %

YEAR END	NON INVESTMENT REVENUE	INVESTMENT INTEREST	TOTAL REVENUE	BUDGET APPROPRIATION	SUPPLE-MENTALS	DEBT SERVICE	PAYMENTS TO FUNDS	TOTAL EXPENDITURE	SURPLUS OR DEFICIT	PERM-ANENT FUND	GENERAL FUND END OF YEAR	REVENUE REQ FOR OF BAL $0 MIL
1977										4.0	652.7	
1978	794.0	56.2	850.2	853.8	0.0	0.0	122.0	975.8	-125.6	84.6	527.1	0.0
1979	1100.8	59.9	1160.7	981.9	0.0	0.0	217.6	1199.5	-38.7	230.2	488.4	0.0
1980	1269.1	69.9	1339.0	1129.2	0.0	0.0	259.5	1388.6	-49.6	410.2	438.8	0.0
1981	1583.2	86.3	1669.5	1298.5	0.0	0.0	296.2	1594.7	74.8	693.4	438.8	0.0
1982	1745.4	107.5	1852.9	1493.3	0.0	0.0	339.0	1832.3	20.6	958.6	438.8	0.0
1983	1925.9	127.1	2053.0	1717.3	0.0	0.0	402.3	2119.6	-66.5	1249.7	372.2	0.0
1984	2069.7	146.0	2215.7	1974.9	0.0	0.0	338.2	2313.1	-97.4	1580.9	274.9	0.0
1985	2251.2	162.5	2413.7	2271.1	0.0	0.0	374.5	2645.6	-231.9	1955.4	43.0	0.0
1986	2403.9	184.6	2588.5	2611.8	0.0	0.0	421.0	3032.8	-444.3	2376.4	-0.0	401.4
1987	2563.4	218.7	2782.1	3003.6	0.0	0.0	471.8	3475.3	-693.2	2848.2	-0.0	693.2
1988	2732.3	258.9	2991.1	3454.1	0.0	0.0	527.2	3981.3	-990.1	3375.4	-0.0	990.1
1989	2910.2	303.8	3214.0	3972.2	0.0	0.0	587.5	4559.7	-1345.8	3962.9	-0.0	1345.8
1990	3096.8	354.1	3450.9	4568.0	0.0	0.0	653.4	5221.4	-1770.6	4616.3	-0.0	1770.6

STATE OF ALASKA
LEGISLATIVE FINANCE WORKING DOCUMENT
BUDGET FORCASTING MODEL

5

21-SEP-77

COMMENTS
ALCAN
TAPS BUILDUP RESUMES MARCH 78
MEDIUM REVENUES (HAGGART CASE II)

ASSUMPTIONS
ANNUAL RATE OF INTEREST ON GENERAL + PERMANENT FUNDS = 7.00%
% OF CURRENT YEAR EXPEND. IN G.F. CASH BAL. = 20.00%
% OF ROYALTIES LEASES AND BONUSES DEPOSITED IN PERMANENT FUND = 30.00%
ANNUAL % INCREASE IN BUDGET APPROPRIATION = 15.00%
% OF PERMANENT FUND EARNINGS TO ALASKA INC = % 100 %
% OF SURPLUS TO PERMANENT FUND = % 100 %

YEAR END	NON INVESTMENT REVENUE	INVESTMENT INTEREST	TOTAL REVENUE	BUDGET APPROPRIATION	SUPPLE-MENTALS	DEBT SERVICE	PAYMENTS TO FUNDS	TOTAL EXPENDITURE	SURPLUS OR DEFICIT	PERM-ANENT FUND	GENERAL FUND END OF YEAR	REVENUE REQ FOR GF BAL OF $0 MIL
1977										4.0	652.7	
1978	794.0	56.2	850.2	853.8	0.0	0.0	122.0	975.8	-125.6	81.6	527.1	0.0
1979	1100.8	59.7	1160.5	981.9	0.0	0.0	217.4	1199.2	-38.7	216.6	488.4	0.0
1980	1269.1	69.0	1338.1	1129.2	0.0	0.0	258.5	1387.7	-49.6	374.9	438.8	0.0
1981	1583.2	83.8	1667.0	1298.5	0.0	0.0	293.7	1592.3	74.8	623.3	438.8	0.0
1982	1745.4	102.6	1848.0	1493.3	0.0	0.0	334.1	1827.4	20.6	833.3	438.8	0.0
1983	1925.9	118.3	2044.2	1717.3	0.0	0.0	393.5	2110.8	-66.5	1049.8	372.2	0.0
1984	2069.7	132.0	2201.7	1974.9	0.0	0.0	324.2	2299.1	-97.4	1285.3	274.9	0.0
1985	2251.2	141.8	2393.0	2271.1	0.0	0.0	353.8	2624.9	-231.9	1540.2	43.0	0.0
1986	2403.9	155.5	2559.4	2611.8	0.0	0.0	391.9	3003.7	-444.3	1814.7	0.0	401.4
1987	2563.4	179.4	2742.8	3003.6	0.0	0.0	432.5	3436.0	-693.2	2109.8	0.0	693.2
1988	2712.3	207.1	2939.4	3454.1	0.0	0.0	475.5	3929.6	-990.1	2426.5	0.0	990.1
1989	2910.2	237.3	3147.5	3972.2	0.0	0.0	521.1	4493.3	-1345.8	2765.9	0.0	1345.8
1990	3096.8	270.3	3367.1	4568.0	0.0	0.0	569.6	5137.6	-1770.6	3129.1	-0.0	1770.6

STATE OF ALASKA
LEGISLATIVE FINANCE WORKING DOCUMENT
BUDGET FORCASTING MODEL

6

21-SEP-77

COMMENTS
ALCAN
TAPS BUILDUP RESUMES MARCH 78
MEDIUM REVENUES (HAGGART CASE II)

ASSUMPTIONS
ANNUAL RATE OF INTEREST ON GENERAL + PERMANENT FUNDS = 7.00%
% OF CURRENT YEAR EXPEND. IN G.F. CASH BAL = 20.00%
% OF ROYALTIES LEASES AND BONUSES DEPOSITED IN PERMANENT FUND = 30.00%
ANNUAL % INCREASE IN BUDGET APPROPRIATION = 15.00%
% OF PERMANENT FUND EARNINGS TO ALASKA INC = 50.00%
RESERVE AS % OF BUDGET ADDED TO REQUIRED GF BALANCE = 10.00%

YEAR END	NON INVESTMENT REVENUE	INVESTMENT INTEREST	TOTAL REVENUE	BUDGET APPROPRIATION	SUPPLE-MENTALS	DEBT SERVICE	PAYMENTS TO FUNDS	TOTAL EXPENDITURE	SURPLUS OR DEFICIT	PERM-ANENT FUND	GENERAL FUND END OF YEAR	REVENUE REQ FOR GF BAL OF $0 MIL
1977	..									4.0	652.7	
1978	794.0	56.3	850.3	853.8	0.0	0.0	120.5	974.3	-124.0	524.9	85.4	0.0
1979	1100.8	59.5	1160.3	981.9	0.0	0.0	227.7	1209.5	-49.3	659.9	36.1	0.0
1980	1269.1	68.8	1337.9	1129.2	0.0	0.0	263.7	1392.9	-55.0	818.2	0.0	18.9
1981	1583.2	84.2	1667.4	1298.5	0.0	0.0	293.1	1591.6	75.8	991.8	75.8	0.0
1982	1745.4	103.4	1848.8	1493.3	0.0	0.0	321.9	1815.2	33.7	1181.3	109.4	0.0
1983	1925.9	120.4	2046.3	1717.3	0.0	0.0	372.7	2090.0	-43.7	1397.7	65.8	0.0
1984	2069.7	136.1	2205.8	1974.9	0.0	0.0	295.5	2270.4	-64.6	1633.2	1.1	0.0
1985	2251.2	155.1	2406.3	2271.1	0.0	0.0	316.5	2587.7	-181.4	1888.1	0.0	180.2
1986	2403.9	178.3	2582.2	2611.8	0.0	0.0	345.4	2957.2	-374.9	2162.6	0.0	374.9
1987	2563.4	203.8	2767.2	3003.6	0.0	0.0	376.0	3379.5	-612.4	2457.7	-0.0	612.4
1988	2732.3	231.5	2963.8	3454.1	0.0	0.0	408.3	3862.4	-898.6	2774.4	-0.0	898.6
1989	2910.2	261.7	3171.9	3972.2	0.0	0.0	442.4	4414.6	-1242.7	3113.8	-0.0	1242.7
1990	3096.8	294.6	3391.4	4568.0	0.0	0.0	478.6	5046.7	-1655.2	3477.1	0.0	1655.2

TABLE 1

PROJECTED ECONOMY ($ MILLION PERSONAL INCOME)	FY	SCENARIO 1		SCENARIO 2		SCENARIO 3		SCENARIOS 4 & 5		SCENARIO 6	
		REQUIRED PERMANENT FUND ($ MILLION)	REQUIRED ECONOMY ($ MILLION PERSONAL INCOME)	REQUIRED PERMANENT FUND ($ MILLION)	REQUIRED ECONOMY ($ MILLION PERSONAL INCOME)	REQUIRED PERMANENT FUND ($ MILLION)	REQUIRED ECONOMY ($ MILLION PERSONAL INCOME)	REQUIRED PERMANENT FUND ($ MILLION)	REQUIRED ECONOMY ($ MILLION PERSONAL INCOME)	REQUIRED PERMANENT FUND ($ MILLION)	REQUIRED ECONOMY ($ MILLION PERSONAL INCOME
2,845.6	78										
3,120.2	79										
3,550.6	80									1,358.2	3,789.8
3,860.7	81										
3,932.9	82										
4,073.4	83					4,899.5	5,540.4				
4,392.4	84					8,109.0	4,695.6				
4,770.8	85					12,011.1	9,026.5			7,036.6	7,051.8
5,008.8	86			1,962.1	5,116.3	18,194.3	11,801.2	Not	10,089.8	12,874.0	9,754.3
5,259.8	87	6,133.0	8,909.2	19,954.4	13,207.9	25,674.7	15,148.4		14,034.4	19,954.8	13,011.5
5,522.7	88	14,303.9	16,131.5	28,448.2	17,093.6	34,585.4	19,125.2	Applicable	18,055.6	28,448.6	16,897.3
5,798.9	89	19,394.7	20,617.8	38,619.1	21,725.4	45,196.7	23,852.1		22,834.3	38,619.5	21,529.2
6,088.8	90	25,475.2	25,973.6	50,768.1	27,236.9	57,810.7	29,462.2		28,501.4	50,768.5	27,040.6

ASSUMPTIONS

FY	1 LA PRICE $	2 LOWER 48 TRANSPORT $	3 TAPS TARRIF $	4 INCOME TAX PRUDHOE ($ MILLION)	5 PRUDHOE PRODUCTION MMB	6 OIL & GAS PROPERTY TAX ($ MILLION)	7 $ FLOOR PRICE FOR OIL SEVERANCE TAX	8 OTHER REVENUE ($ MILLION)	9 GAS SALES MM/MCF	10 GAS SALE PRICE ¢/MCF	11 COOK INLET OIL ROYALTY ($ MILLION)	12 COOK INLET OIL SEVERANCE ($ MILLION)
78	13.75	1.50	5.40	35.0	262.5	167.3	6.53	225.8	17.0	39.8	33.1	16.3
79	14.44	2.00	5.40	51.0	474.5	170.6	6.53	346.5	20.4	39.8	31.3	14.4
80	15.16	2.50	5.40	54.0	547.5	193.2	7.18	280.5	26.4	41.6	29.5	12.7
81	15.92	2.50	5.40	55.0	547.5	226.7	7.18	305.0	34.0	44.2	27.9	10.9
82	16.71	2.50	5.40	56.0	547.5	251.8	7.90	310.7	37.6	46.8	26.4	9.1
83	17.55	2.50	4.90	58.0	547.5	257.0	7.90	321.8	111.6	50.9	24.6	7.3
84	18.43	2.50	4.90	59.0	547.5	261.4	8.69	347.0	117.4	73.1	22.9	5.5
85	19.35	2.50	4.90	60.0	547.5	295.9	8.69	376.9	122.0	77.1	21.2	3.7
86	20.31	2.50	4.90	62.0	547.5	310.7	9.55	395.7	122.0	77.1	19.7	1.9
87	21.33	2.50	4.90	63.0	547.5	326.2	9.55	415.5	122.0	77.1	18.4	.1
88	22.40	2.50	4.90	64.0	547.5	342.5	10.51	436.3	122.0	77.1	17.1	--
89	23.52	2.50	4.90	66.0	547.5	359.7	10.51	458.1	122.0	77.1	16.0	--
90	24.70	2.50	4.90	67.0	547.5	377.6	11.56	481.0	122.0	77.1	14.9	--

FOOTNOTES:

1. Haggart Case II (5% annual increase, July 14, 1977 Memo
2. Haggard Case II
3. Haggart Case II as revised for FY 78-82 in his July 15, 1977 memo for pump station no. 8 slowdown
4, 5. Haggart Case II revised for FY 78 for pump station no. 8 slowdown
6. Haggart Case II revised for FY 78 for missing pump station no. 8
7. Haggart (10% increase every two years)
8. Department of Revenue; "Alaska's Oil & Gas Tax Structure"; p. IV-32; Alcan scenario

9-12. Haggart

Alaska State Legislature

House

JUNEAU ALASKA

March 14, 1977

Alaska Permanent Fund Committee
Pouch V
Juneau, Alaska 99811

Daniel A. Seiver
Institute of Social & Economic Research
University of Alaska
2651 Providence Drive
Anchorage, Alaska 99504

Dear Mr. Seiver:

The Anchorage Daily News carried an article last Monday about a computer forecast you made on inflation and unemployment in Alaska this year. Since the Permanent Fund could have a major effect on the Alaska economy and population, we would like to find out about the capabilities of your economic model for potential use by the committee, which will be based in Anchorage this summer.

Please send, if possible, a short written description of the model, including an estimate of the cost for use by the committee. You might also let us know how much the model could be expanded to include the effects of various alternative uses of the Permanent Fund on the Alaska economy. Thank you for your help.

Sincerely,

Brian Rogers, Administrative Assistant
Permanent Fund Committee

PLEASE NOTE

THE ORGINAL FILE CONTAINS AN OVERSIZED DOCUMENT THAT IS UNSUITABLE FOR FILMING. PLEASE REFER TO THE ALASKA STATE ARCHIVES TO VIEW THE ORIGINAL.

DESCRIPTION: NEWSPAPER TABLOID

University Reporter , THE STUDENT NEWSPAPER

SEPTEMBER 20, 1977 - VOLUME III ISSUE 2 - UAA/ACC

(THE UNIVERSITY REPORTER
2533 PROVIDENCE AVE.
ANCHORAGE, ALASKA 99504)