ALASKA FISHERIES POLICY

ECONOMICS, RESOURCES, AND MANAGEMENT

Edited by

Arlon R. Tussing
Thomas A. Morehouse
and James D. Babb, Jr.

Institute of Social, Economic and Government Research
University of Alaska

FISHERIES MANAGEMENT: THE COOK INLET AND BRISTOL BAY CASES

George W. Rogers

INTRODUCTION

Fisheries management in Alaska, as elsewhere, has been concerned primarily with preventing overexploitation and promoting the sustained yield of commercially valuable fish stocks. Though laudable objectives, they represent only fragments of what should be the ultimate ends of management policy. Adherence to biological principle has led to the deliberate imposition of inefficiency upon harvesting activities in the interest of conservation, the classic case being the prohibition of power boats in the hazardous Bristol Bay salmon fishery until the 1950's. Fisheries administrators have always been aware, however, that there are more than biological dimensions to fisheries management and, in practice, they do attempt to take more into account than the scientific advice of their staff biologists.

In another essay in this volume, J.S. Crutchfield treats the formulation of fisheries management policy as essentially political decision making in which the economist should play an important role.[1] In his view, the economist is "charged with the responsibility for indicating the superior choice of action insofar as economic efficiency is concerned," and he discusses the nature of this responsibility and means of fulfilling it. At the outset, he clearly defines the limitations of economic analysis:

> These remarks apply, however, only to the efficiency effects of regulatory actions. These actions may also have distribution effects and here the role of the economist parallels that of the fishery scientist. He can clarify alternatives but cannot provide any basis, on economic grounds, for choosing among them.[2]

Crutchfield and other economists have presented bio-economic models of fisheries that shed light on the efficiency effects of regulatory alternatives. These models, in turn, support proposals for more rational (in biological and economic terms) management through the limitation of entry as a means of decreasing productive factor costs and economic rent dissipation without sacrifice to the scientific biological management of the resource. This represents a revolutionary breakthrough, but, as Crutchfield points out, these analytical tools "provide no basis for distribution decisions" (i.e., who gets what, how much, how, and when).

Maintenance of fish stocks and economic efficiency are matters of grave concern in Alaska fisheries management, but most of the popular controversy has focused on matters of distribution of the shares in the yield of these fisheries. Indeed, much of the drive for statehood came from a desire of resident interests in fisheries and other natural resources to receive a greater share of the yield of their harvests, and this desire continues to exert a powerful influence in management politics.[3]

In considering a limited entry policy recommended by the bio-economic model, the Alaska Department of Fish and Game recently asked several questions not only about economic efficiency, but also about factors not contemplated in the model:

> What effect will alternative limited entry proposals have on the resident-nonresident aspects of Alaska's fisheries? What effect will limited entry have on the present and future livelihood of members of fishing villages totally dependent on fishing—especially that of Natives who characteristically do not have educational, social, or psychological mobility enabling them to move to urban centers for work in other industries? Who would be prevented from fishing if a history of consecutive fishing over 3 years, 5 years, x-years was required to qualify for a license? Who would likely remain in the fishery if license fees were increased 5-fold, 10-fold? . . . How can a system of limited entry be instituted such that it does not create a rich class of elite fishing barons at the exclusion of others entitled to a decent living? What is the impact and effect of gear limitation on sport and subsistence fisheries?[4]

These questions go beyond concern for the health and perpetuation of the fish stock or the industry and focus on the fishermen, their dependents, and their communities.

Each of the established social science disciplines might be applied in turn to answer these questions, but, as in the case of economic analysis, this would yield only fragments of policy within the purview of the separate disciplines—not an integrated policy relating equally to fishermen, the fisheries, and the industry. To answer the department's questions requires a unified approach that would identify and quantify the inter-relationships between a specific fisheries region, its population, and the economic, political, and social systems embraced within its boundaries. Not all variables can or should be dealt with, but a selection can be made of those that are central to the region's processes of harvesting and production and strategic to the stated ends of management.

This paper analyzes two major Alaska fisheries regions, Cook Inlet and Bristol Bay. In each, the harvest of fish is an important or dominant element of the local economy, but each also presents contrasting economic and social environments. The brief discussion of limited entry implications of the characteristics of each region and its fishermen is not intended as an evaluation of the policy or a full indication of the forms entry limitation might take. The purpose is merely to use a policy issue, which is discussed more fully elsewhere in this anthology, as a means of suggesting general directions for further management research. The closing discussion returns to an evaluation of the bio-economic models referred to in this introduction.

THE COOK INLET REGION

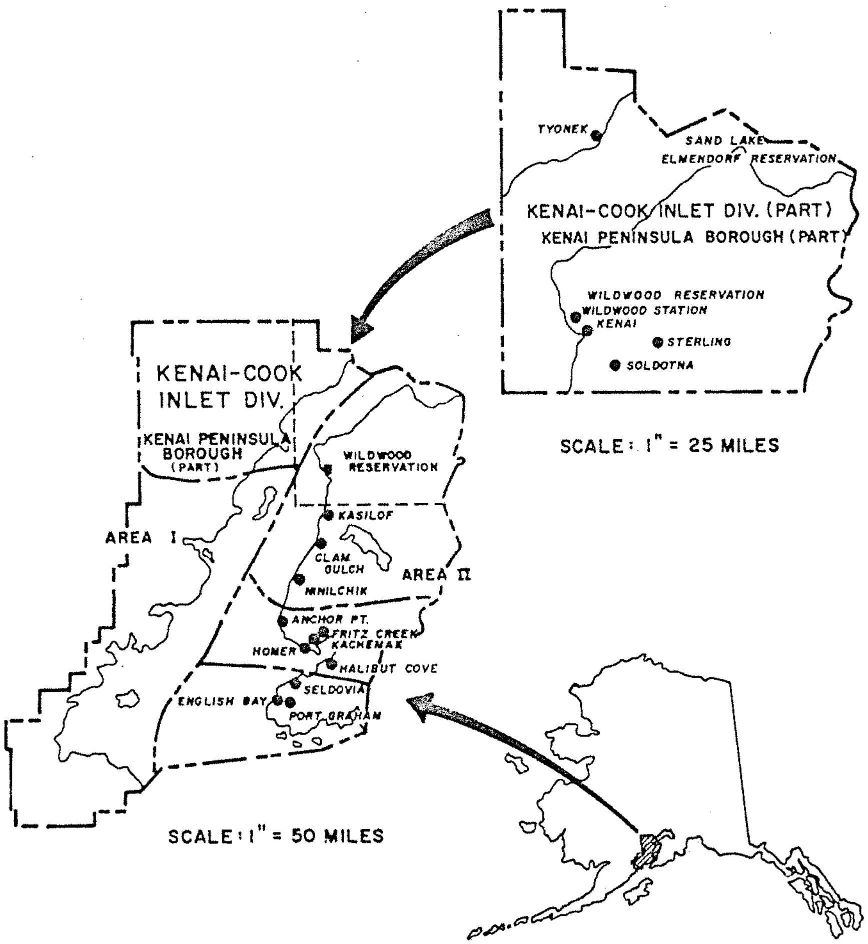
The Cook Inlet Region, Its Development and Population

Cook Inlet is a long, narrow embayment in the southcentral coast of Alaska, bordered on the east by the Kenai Peninsula and on the west by the Alaska Range. At its northern end it branches into Turnagain Arm and Knik Arm, which merges into the deltas of the Susitna, Matanuska and Knik rivers. The area of these waters is approximately 50,000 square miles, or about the size of the state of New York. The following analysis is confined to the area embraced by the 1970 Kenai-Cook Inlet Census Division (Figure 1).

In aboriginal times, this territory was that of the Tanaina Indians, who settled along the shores of the inlet, the large lakes on the Alaska Peninsula, and the main branches of the river system. Their livelihood was based on the availability of salmon and other fish, sea mammals in the inlet, and land mammals upriver. Russian settlement was a response to the fur trade (sea otter and fur seals

Figure 1

Cook Inlet Region
(Places listed in 1970 Census.)



from the lower inlet and land furs by trade with interior Indians), and initial American occupation was a response to the harvesting and canning of salmon. There was some small-scale mining activity, but until the discovery and development of petroleum resources, the resident and nonresident seasonal population was tied primarily to a combination subsistence and commercial fishing and fish processing economy. Related to these activities were homesteading and a modest agricultural production supported by the seasonal cash income earning opportunities in fishing and fish processing.

From the mid-1950's through the 1960's, defense and petroleum activities generated rapid economic growth and a basic shift of settlement patterns. Oil was found at Swanson River in 1957 and, within a decade, a total of 15 oil and gas fields had been discovered in the upper and middle inlet areas. A start was made on a petro-chemical and processing industry north of Kenai, producing ammonia and urea and liquified natural gas for export to Japan and a limited range of products for Alaska consumption. Commercial production of natural gas began with the completion of the Kenai-Anchorage gas line in 1961.

The rise and decline of defense activities also can be traced briefly. The 1950 census reported one military person in the Homer district and two within the Kenai district. Following the construction of two military facilities during the 1950's, the 1960 census reported 639 persons residing at the Wildwood Station in the Kenai district (305 military and 334 civilians) and 102 military personnel at the Ohlson Mountain Air Force Station in the Homer district. The 1970 census reported 750 persons residing at the Wildwood Station (417 military and 333 civilians), 67 military personnel at Kenai, and none in the Homer district. Since the 1970 census, the military stations have been totally phased out.

As elsewhere in Alaska, the most important long-run effect of defense activities has been upon the area's transportation system. Prior to the 1950's, the settlements were linked together mainly by water transportation supplemented in later years by air service. Largely justified by defense requirements, a five-year highway construction program launched in 1950-51 pushed a road from Anchorage around the upper Turnagain Arm area, across the Kenai Peninsula, and down the Cook Inlet coast to Homer. Improvement of this road system has provided a means of unifying the region's population, ready access to the metropolitan center of Anchorage, and a link to the continental highway system. This has opened local

Alaska markets to the fisheries and recreational resources of the region, and has increased the part-time and seasonal participation of Anchorage residents in the region's economy. In 1964, the Alaska Marine Highway System was extended to the region, with regular passenger, automobile, and freight carrying service between Anchorage, Homer, Seldovia, Kodiak, and Seward.

These economic forces are registered in population changes (Table 1). Between 1880 and 1950, total population growth was modest and lagged behind the growth rates of the larger southcentral Alaska region. While the Cook Inlet population rose from 980 to only 1,200 between 1909 and 1920, the Anchorage division population increased six-fold, from 500 to 3,130 during the same period. Between 1939 and 1950, the Cook Inlet population remained virtually constant, while that of the Anchorage division increased eight-fold. But with the 1957 discovery of oil and the development of petroleum and natural gas fields in the upper Cook Inlet and on the Kenai Peninsula, the Cook Inlet population tripled between 1950 and 1960 and doubled in the next decade.

The 1970 census reports divide the region into two major areas, one which is served by the road system and where almost all the population growth has occurred, and the other served only by water and air transportation and which has grown hardly at all. Although the introduction of roads in the first area was not the primary cause of its rapid population growth, the opening of the region to week-enders and vacationing motorists led to increased employment in trade and services beyond those required by the region's resident population and caused a further expansion in total population. Directly attributable to the construction and maintenance of the road system was the establishment of two new communities in the upper inlet area, Soldotna in 1949 and Sterling in 1954. Most importantly, the road system effected the pattern of settlement. Whereas prior to 1960, most of the population of the Kenai district was reported as living in places of concentrated settlements identified by the census, in 1970 it was reported that 47 per cent of the district's population was located in fringe developments outside the boundaries of such places or in strip settlements along the road.

Other effects of these developments are registered in the general social and economic characteristics of the population, as reported in the 1960 and 1970 census (earlier comparisons are not possible). Although the Native Alaskans in the region were an important minority group prior to 1950 and were the dominant population

TABLE 1

Cook Inlet Region*—Population Distribution, 1880-1970

	Jun. 1, 1880	Jun. 1, 1890	Jun. 1, 1900	Dec. 31, 1909	Jan. 1, 1920	Oct. 1, 1929	Oct. 1, 1939	Apr. 1, 1950	Apr. 1, 1960	Apr. 1, 1970
TOTAL	689	990	960	980	1,218	1,224	1,613	2,141	6,097	14,250
CENSUS AREA I[a]										
West Side of Inlet										
Tyonek	117	115	100	80	58	78	136	132	187	232
Other places	91	85	...	...	...	...	...	...	25	46
Seldovia District										
Seldovia	74	99	149	173	258	379	410	437	460	437
Other places	88	107	111	127	192	107	172	264	234	243
Subtotal	390	406	360	380	508	564	718	833	906	958
CENSUS AREA II[b]										
Homer District										
Military station	...	...	...	...	...	...	...	...	102	...
Other places	...	...	100	100	210	192	398	810	1,905	2,301
Kenai District										
Kenai	44	264	290	250	332	286	303	321	778	3,533
Military base	...	...	...	...	...	...	...	...	639	750
Other places	275	320	210	250	168	182	194	177	1,767	6,708
Subtotal	319	584	600	600	710	660	895	1,308	5,191	13,292

*Earlier data adjusted to reflect same area as 1970 Kenai-Cook Inlet Census Division.

[a]Census Area I: All places without surface land connections.

[b]Census Area II: All places connected by roads in 1970 census.

SOURCE: U.S. Bureau of the Census

group prior to 1920, in 1960 and 1970 they comprised only 13 per cent and 7 per cent of the total population. Median family incomes in 1970 were above the state medians and the percentage of families below the Alaska "poverty line" dropped from 35 per cent in 1959 to 10 per cent in 1969. The infant mortality rate decreased dramatically to half the state rate by 1970 (Table 2).

The Cook Inlet Regional Economy

The economic importance of the Cook Inlet region to the state and nation can be guaged by assigning a gross dollar value to each of the major economic activities described above. Table 3 summarizes estimates for the period 1960 through 1970. Prior to 1961, the value of fisheries products was the most important element of the regional economy. Although since surpassed manyfold by the value of crude petroleum and natural gas, commercial fisheries continue to play an important role. In 1970, fisheries products harvested and processed within the region represented 6 per cent of the total state value of all fisheries products. Between 1960 and 1970, all of the state's commercial crude oil and natural gas products came from the region. Department of Defense activities were significant to the region, but were on the way out by the end of the decade. Other values were relatively insignificant.

These gross values adequately represent the region's overall economic importance, but give a false impression of the local economy itself. Much of the total value of production and defense spending escapes the local economy in the form of profits, interest, equipment and supplies purchased outside the region, transport costs, and wages paid to nonresident seasonal workers. A more respresentative calculus of the local economy can be made from employment data (Table 4). These data are not classified by residence, however, and include seasonal workers who regularly migrate to Alaska for fishing and food processing work during the summer.

Within the "commodity producing" sector, employment in agriculture and fishing remained fairly stable from 1960 to 1970, with the exception of a peaking of fishing activities in mid-decade. Food processing (primarily fish processing) rose to a higher plateau by mid-decade. This resulted from product diversification, with greater emphasis on labor-intensive specialty items, and the airlift of surplus salmon from Bristol Bay for processing in the Cook Inlet

TABLE 2
General Social and Economic Characteristics of Population, Cook Inlet Region,* 1960, 1970

	April 1, 1960	April 1, 1970
Total Population	6.097	14.250
Native	778	963
Non-native	5.319	13.287
Family Income and Poverty Status[a]		
Median income, all families with income	$5,311	$12,969
Percent of families with:		
income less than poverty level	29.6%	7.1%
income less than 75% poverty level	23.2	5.5
income less than 125% poverty level	34.7	9.7
income *more* than 125% poverty level	65.3	90.3
Educational Attainment (persons 25 years old and over):		
Median years completed:		
males	11.7	12.3
females	12.1	12.5
Percentage high school graduates:		
males	47.8%	62.8%
females	53.0	70.2
Infant Mortality Rates (deaths under 1 year of age per 1,000 live births):	57.7	12.1
Weeks Worked in 1969		
Percent of males 16 years and over:		
50-52 weeks		52.0%
27-49 weeks		24.0
26 weeks or less		15.8
did not work		8.2
Percent of females 16 years and over:		
50-52 weeks		13.8%
27-49 weeks		14.0
26 weeks or less		22.7
did not work		49.5
Labor Mobility for Males[b]		
Percentage of males 30-49 years old in 1970:		
nonworker 1965, nonworker 1970		4.6%
nonworker 1965, worker 1970		10.6
worker 1965, worker 1970		73.1
worker 1965, nonworker 1970		11.7

*Kenai-Cook Inlet Census Division (1970), District (1960).

[a]Excludes inmates of institutions, members of Armed Forces, college students in dorms, unrelated individuals under 14 years. 1970 poverty line for all families = $3,388. Poverty line 1960 for all families = $3,000.

[b]"Worker" includes members of Armed Forces.

SOURCE: U.S. Bureau of the Census 1970: PC(1)-C3, Alaska; 1960: PC(1)-3C Alaska. Infant mortality data from Alaska Department of

TABLE 3

Cook Inlet Region—Estimated Department of Defense Expenditures and Value of Major Natural Resources Production

Calendar Year	Department of Defense	Total Natural Resource Products*	Crude Petrol. and Nat. Gas	Commercial Fisheries Products: Value to fishermen	Commercial Fisheries Products: Value added by manufacturing	Commercial Agricultural Products
	(Millions of Current Dollars)					
1960	3.6	11.5	1.5	3.3	6.4	0.1
1961	3.3	27.3	17.8	2.2	6.8	0.2
1962	3.3	42.7	31.7	5.9	4.1	0.2
1963	3.2	43.0	33.8	2.4	5.9	0.3
1964	2.6	46.9	35.5	4.3	6.4	0.3
1965	1.5	45.2	35.6	2.9	6.1	0.4
1966	2.2	65.0	50.4	5.6	7.9	0.3
1967	2.9	104.5	95.5	3.3	5.2	0.2
1968	3.6	204.0	191.1	6.4	6.2	0.2
1969	5.8	230.1	218.7	3.0	8.3	0.1
1970	1.2	269.5	256.7	4.9	7.2	0.1

*Includes estimate for miscellaneous mining, furs, local forest products production, tourism.

Department of Defense: Estimated military and civilian payrolls and operation and maintenance expenses.

Crude Petroleum and Natural Gas: Crude oil and natural gas at wellhead price. Data not available to estimate value added by manufacturing.

Fisheries Products: Value added by manufacturing = wholesale value at final stage of processing within region less value of catch to fishermen.

Commercial Agricultural Products: Sales value at farm.

SOURCE: Alaska departments of Natural Resources and Fish and Game. Estimates of Defense from data in "Defense Spending in Alaska," *Alaska Review of Business and Economic Conditions*, ISEGR, July 1971, Vol. VIII.

TABLE 4

Cook Inlet Region—Population, Employment, 1960-1970

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
	12-Month Averages										
Total Population	6,097	6,835	7,795	8,370	7,943	8,446	9,020	9,400	11,300	13,550	14,250
Total Employment	1,793	1,950	2,286	2,394	2,393	2,689	3,593	5,152	6,157	5,947	4,917
Participation rate (%)	29.4	28.5	29.3	28.6	30.1	31.8	39.8	54.8	54.5	43.9	34.6
Government											
Federal: Military[a]	407	403	396	396	300	154	200	250	300	453	100[p]
Civilian	60	60	85	80	90	90	100	101	115	118	119
State and Local	220	234	312	323	290	355	495	510	526	583	632
Subtotal	687	697	793	799	680	599	795	861	941	1,154	651
Commodity Producing Industries											
Agriculture[b]	106	106	106	106	106	106	106	106	106	106	106
Fishing	210	200	200	250	240	158	203	188	212	232	255
Mining (includes oil and gas)	50	155	169	159	179	212	415	915	1,099	966	652
Contract Construction	50	57	94	99	128	259	367	821	1,209	736	354
Food Processing (primarily fish products)	180*	170*	198*	236*	226	219	213	216	225	263	347
Other manufacturing					40	45	45	44	108	219	236
Subtotal	596	688	767	850	919	1,002	1,349	2,290	2,959	2,522	1,968

Table 4 (continued)

Cook Inlet Region—Population, Employment, 1960-1970

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
Distributive Industries											
Transportation, Communications, Utilities	80	90	104	94	107	125	141	306	267	273	293
Trade	100	113	134	152	151	219	303	357	432	528	507
Finance, Insurance, Real Estate, Services[c]	230	132	188	179	186	267	391	476	569	540	498
Subtotal	310	335	426	425	444	611	835	1,139	1,268	1,341	1,298
Unclassified Employment (nonagricultural)											
Self-employed and unpaid family workers	200	230	300	320	350	477	614	862	989	930	800

*Combined to avoid disclosure of individual firm data.

p = preliminary estimate.

[a]Military personnel stationed in area as of July 1 (Alaska Command).

[b]Includes self-employed, unpaid family workers and wage argricultural workers.

[c]Includes domestics.

SOURCE: Military and total population from Alaska Department of Labor, *Current Population Estimates by Election Districts, Alaska*, published annually. Fishing employment from study of commercial fisheries employment by G.W. Rogers, R. Listowski, and J. Brakel for U.S. Department of Commerce. All others from Alaska Department of Labor, *Alaska Workforce Estimates, by Industry and Area*, published annually, and office records.

region in 1969 and 1970. "Other manufacturing" rose sharply in the last three years of the period in response to the growth of petroleum related activities. Federal civilian and state and local government employment rose throughout the period in response to the needs of a growing local population and industrial development, while the number of military personnel declined. Mining and contract construction recorded dramatic rises as petroleum developments advanced during the period, and then sharply declined during the last two years as the industry achieved a less labor-intensive production phase. For the future, fishing and food processing will continue as important and relatively stable elements in the regional economy. Tourism and outdoor recreation undoubtedly will grow. Unless there is a major new cycle of discovery, mining employment (oil and gas) will continue to decline, then follow a lower plateau for a period of about 20 years of prime production of the presently developed and potential lower inlet fields, and then drop to a lower level during a final decade of marginal salvage production.

Annual averages give only a part of the picture of the Cook Inlet economy. It is necessary to look at monthly data to get a fuller understanding of its operations. Tables 5 and 6 present employment by months for calendar years 1965 and 1970. The fishing and food processing industries register the most marked seasonal patterns, and exert an influence on the seasonal patters of "distributive" industries. Mining employment by months shows seasonal fluctuation, but the figures also include the influence of longer duration trends; both forces clearly affect contract construction

Cook Inlet Commercial Fisheries and Fish Processing Industry[5]

The subsistence value of the region's fisheries have already been noted in the discussion of aboriginal settlement. Although a dollar value cannot be readily assigned, subsistence and sports fishing continue as vital elements of the economy.

Until the present decade, salmon fishing was dominant in the Cook Inlet commercial fisheries, and canned salmon was the largest product by value and weight. Salmon salting on a commercial basis began on the Kenai River in 1878, and the first salmon cannery was erected at Kasilof in 1882. Industry output reached an average annual production of 146,400 cases during the 1920's, 225,700 cases during the 1930's, 278,700 cases during the 1940's, 256,900 during the 1950's, and 263,200 during the 1960's.

TABLE 5

Cook Inlet Region Employment By Month and Industry, 1965

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	12-Month Ave.
al Employment	1,559	1,563	1,703	1,985	2,330	3,173	4,440	3,488	3,503	3,100	2,822	2,546	2,684
ernment													
deral: Military[a]	154	154	154	154	154	154	154	154	154	154	154	154	154
Civilian	80	80	85	90	90	90	100	100	100	90	90	90	90
ate and Local	247	257	252	248	254	286	361	377	508	483	490	485	355
Subtotal	481	491	491	492	498	530	615	631	762	727	734	729	598
mmidity-Producing istries													
riculture[b]	36	36	65	76	110	133	148	186	241	145	51	51	106
mmercial Fishing	11	4	39	46	32	185	1,133	302	127	--	8	4	158
ning (includes il and gas)	77	87	105	186	251	286	247	255	263	241	287	261	212
ntract Construction	84	88	82	92	127	296	410	450	578	450	302	151	259
od Processing primarily fish roducts)	81	71	98	176	357	449	467	273	159	144	162	186	219
her Manufacturing	24	45	38	40	47	57	58	55	50	47	40	41	46
Subtotal	323	331	427	616	924	1,406	2,463	1,521	1,418	1,027	850	694	1,000

Table 5 (Continued)

Cook Inlet Region Employment By Month and Industry, 1965

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	12-Month Ave.
ibutive Industries													
nsportation, Communi-cations, Utilities	109	102	111	126	132	136	124	128	131	137	123	126	125
de	170	167	178	177	200	215	277	274	260	228	237	240	218
ance, Insurance, eal Estate													
rvices[c]	177	164	178	201	233	294	310	324	322	355	336	319	267
Subtotal	456	439	467	504	565	645	711	726	713	720	696	625	610
assified Employment agricultural and paid family workers	299	302	318	373	343	592	651	610	618	626	542	432	476

[a]Military personnel stationed in area as of July 1 (Alaska Command).

[b]Includes self-employed, unpaid family workers and wage agricultural workers.

[c]Includes domestics.

RCE: Military from Alaska Department of Labor, *Current Population Estimates by Election Districts, Alaska*, published annually. Fishing employment from study of commercial fisheries employment by G.W. Rogers, R. Listowski, and J. Brakel for U.S. Department of Commerce. All others from Alaska Department of Labor, *Alaska Workforce Estimates, by Industry and Area*, published annually, and office records.

TABLE 6

Cook Inlet Region Employment by Month and Industry, 1970

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	12-month ave.
Employment	4,336	4,345	4,411	4,461	4,770	5,180	6,637	5,924	5,027	4,818	4,504	4,408	4,899
vernment													
ederal: Military[a]	100	100	100	100	100	100	100	100	100	100	100	100	100
Civilian	94	98	96	127	125	126	124	134	127	122	124	135	117
tate and Local	571	593	599	611	624	617	608	677	647	663	651	717	632
Subtotal	765	791	795	838	849	843	832	911	874	885	877	951	851
mmodity Producing lustries													
griculture[b]	36	36	65	76	110	133	148	186	244	145	51	51	106
ishing	71	92	35	37	41	273	1,458	623	180	114	66	68	255
ining (includes oil and gas)	641	625	630	660	625	626	703	750	729	645	590	598	652
ontract Construction	308	309	328	287	360	366	355	371	412	451	383	317	354
ood Processing (primarily fish products)	171	190	193	218	364	510	710	661	307	300	302	242	347
ther Manufacturing	240	247	251	252	238	246	230	236	225	225	228	220	286
Subtotal	1,467	1,499	1,502	1,530	1,738	2,154	3,604	2,827	2,094	1,880	1,620	1,496	1,950

Table 6 (Continued)

Cook Inlet Region Employment by Month and Industry, 1970

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	12-month avc.
ibutive Industries													
nsportation, Communication, Utilities	309	306	322	324	317	289	254	260	262	300	293	277	293
de	518	420	479	496	514	503	550	511	512	501	513	514	507
ance, Insurance, eal Estate													
rvices[c]	532	530	547	513	534	544	505	502	474	443	431	414	498
Subtotal	1,359	1,316	1,348	1,333	1,365	1,336	1,310	1,273	1,248	1,244	1,227	1,205	1,298
assified Employment agricultural self-ployed and unpaid ily workers)	745	739	766	760	818	817	891	913	805	809	785	755	800

[a]Military personnel stationed in area as of July 1—(Alaska Command)—preliminary estimates.

[b]Includes self-employed, unpaid family workers and wage agricultural workers.

[c]Includes domestics.

RCE: Military from Alaska Department of Labor, *Current Population Estimates by Election Districts, Alaska*, published annually. Fishing employment from study of commercial fisheries employment by G.W. Rogers, R. Listowski, and J. Brakel for U.S. Department of Commerce. All others from Alaska Department of Labor, *Alaska Workforce Estimates by Industry and Area*, published annually, and office records.

A variety of forms of gear are now used in salmon harvesting, but until 1958 the most important form was the company owned fish trap. Until the 1950's, traps accounted for almost half the salmon catch, and seines and set gill nets accounted for the balance. With the establishment of a drift gear fishery in 1947, the percentage of catch shifted away from traps to this new form. Drift gear became the dominant form of harvesting after the first state legislature prohibited traps in 1959 (Table 7). This had important implications for the residents of the region. Traps were the most efficient means of taking salmon and their elimination meant a shift to more labor-intensive modes. This also marked the end of dominant nonresident (i.e., Seattle based companies) control of harvesting.

TABLE 7

Cook Inlet Region—Percentage of Salmon Catch by Gear, 1945-1968

Year	Trap	Seine	Drift Net	Set Net
		(percent of total catch)		
1945	44	33	--	23
1946	44	28	--	28
1947	46	22	1	31
1948	47	12	5	36
1949	41	12	21	26
1950	37	7	34	22
1951	30	12	37	21
1952	28	23	23	26
1953	15	20	31	34
1954	32	8	24	36
1955	13	42	29	16
1956	31	6	33	30
1957	9	20	47	24
1958	19	23	23	35
1959	--	14	31	55
1960	--	17	26	57
1961	--	18	50	32
1962	--	30	25	45
1963	--	19	46	35
1964	--	19	35	46
1968	--	12	47	41

SOURCE: J. Rearden, *Status of the Cook Inlet-Resurrection Bay Commercial Salmon Fishery, 1965*, Alaska Department of Fish and Game, Information Leaflet No. 69, p. 11. and L.B. Flagg, *An Economic Survey of the Cook Inlet Salmon Fishery*, Alaska Department of

Clams have been canned since 1923, but the annual harvests and value of products remained small. It was not until after the introduction of freezing plants and the development of crab and other shellfish resources that the commercial fisheries of the inlet became significantly diversified during the 1960's.

The king crab fishery in the inlet started in 1951, when 6,619 pounds were landed from Kachemak Bay pots and trawls. Between 1953 and 1959, the average annual production was 1.4 million pounds. The catch jumped to 4.3 million pounds in 1960, rose to 6.9 million pounds in 1962, to 8.4 million pounds in 1963, and dropped to 6.8 million pounds in 1964. Since then, the annual catch appears to have stabilized at around 3 to 4 million pounds annually. (In 1969, a quota system was established setting a 2 million pound quota on Kachemak Bay and 2.5 million pounds on Kamishak.)

The dungeness crab fishery also started in 1951. The peak catch in 1963 was 1.7 million pounds, but the annual average for the period 1961-71 has been 337,041 pounds. Tanner crab has been harvested commercially since 1968, with an annual average catch of 1.3 million pounds.

The first attempt at establishing a commercial shrimp fishery was made in 1959, when 4.4 million pounds of shrimp were harvested in the lower inlet. For the decade of the 1960's, the annual catch averaged about 0.8 million pounds, but rose to 5.8 million pounds in 1970 and 5.5 million pounds in 1971.

Catch and value to fishermen statistics for the 1960's are summarized in Table 8. Annual fluctuations in the salmon catch reflect the aggregate biological cycles of the several species and races. With the exception of the overkill of king crab in 1963, the shellfish catch data reflect the steady growth and stabilization of the recently established fisheries in the lower inlet. The variety and relative importance of fisheries products are indicated in the summary data for the 1970 season (Table 9). A comparison of the values in tables 8 and 9 indicates the amount of "value added by manufacturing" (53.5 per cent of total wholesale value for salmon products and 67.3 per cent for shellfish). Comparison of weights indicates the loss or waste incurred in processing (40.7 per cent of original weight for salmon and 75.1 per cent for shellfish). The 1970 value per pound to fishermen was higher for salmon ($0.19) than for shellfish ($0.13), but the value per pound of finished products was sharply reversed ($0.68 for salmon products and $1.63 for shellfish). The spread in

TABLE 8

1960-1970 Cook Inlet Catch Data and Value to Fishermen

	Salmon in lbs.	Salmon Value to Fishermen	Shellfish in lbs.	Shellfish Value to Fishermen	Misc. Fish in lbs.*	Misc. Fish Value to Fishermen*
1960	20,587,761	2,882,287	4,882,885	442,155	--	--
1961	13,888,500	1,666,620	5,805,461	519,614	--	--
1962	38,375,937	5,756,391	8,040,287	187,722	--	--
1963	12,583,318	2,013,331	11,957,518	412,360	--	--
1964	37,523,304	6,754,195	5,987,229	888,387	--	--
1965	14,108,000	2,505,000	2,958,400	346,937	3,749	49
1966	26,849,325	5,101,372	4,313,848	459,907	--	--
1967	14,573,059	2,937,614	3,873,115	373,584	19,800	19,000
1968	28,010,053	5,321,910	4,579,681	1,030,889	46,017	36,217
1969	9,125,734	1,924,428	6,232,737	1,031,897	1,179,301	123,599
1970	18,451,507	3,456,011	11,133,574	1,469,837	8,452	2,377

*Halibut not included.

SOURCE: Compiled from Alaska Department of Fish and Game records.

TABLE 9

1970 Cook Inlet Production and Wholesale Value
By Species and Type Product

	Pounds	Wholesale Value	Wholesale Value/lb.
SALMON			
Fresh	2,922	3,528	
Frozen			
Salmon	2,033,901	789,915	
Eggs	19,142	16,890	
Cured			
Salmon	5,894	11,593	
Eggs	744,098	923,942	
Canned	8,140,574	5,689,334	
Subtotal	10,946,531	$7,435,202	$0.68
SHELLFISH			
Fresh Shrimp	312	468	
Frozen			
King Crab	1,373,790	2,820,758	
Dungeness Crab	54,025	44,302	
Tanner Crab	395,692	546,529	
Shrimp	944,797	1,087,013	
Canned			
Clams	345	1,160	
Dungeness Crab	293	1,200	
Subtotal	2,769,254	$4,501,430	$1.63
OTHER FISH			
Fresh Halibut	10,485	4,194	
Frozen Halibut	270,948	133,996	
Herring Bait	13,000	1,324	
Subtotal	294,433	$139,514	$0.47
TOTAL ALL PRODUCTS	14,010,218	$12,076,146	$0.86

SOURCE: Alaska Department of Fish and Game.

The Commercial Fisherman[6]

The closest that available statistics and reports come to describing commercial fisherman is the listing of units of gear engaged or number of fishing licenses issued annually. Although not do provide indices of changes in relative levels of harvesting activity and efficiency. It is common knowledge, however, that a significant number of license holders each year fails to engage in the actual harvest; a recent check of ages of license holders revealed a number of children and infants who were licensed obviously to establish "grandfather" rights in the face of impending limited entry regulations. Furthermore, a number of the license holders are weekend or vacation fishermen seeking supplements to their teaching, office, and homesteading incomes, or tax deductions in support of pleasure craft.

A current study of 1965-70 commercial fishing employment provides estimates of the weekly average fishing employment per month, based on data from Alaska Department of Fish and Game fish tickets. Table 10 summarizes the preliminary results. (These data are also the sources of the total fishing employment figures in tables 4, 5, and 6.) The salmon fishing effort is concentrated in July and August, with minor employment in June and September. In contrast, employment in shellfish is year-round, with monthly fluctuations; the drop in June and July probably indicates some transfer to salmon fishing. This difference in seasonal patterns of monthly employment in the salmon and shellfish fisheries also indicates the resident or nonresident orientation of employment in the two fisheries. Because it is a year-round enterprise, the harvesting of shellfish is necessarily by resident fishermen. On the other hand, a 1968 survey of active commercial salmon fishermen revealed that 23 per cent were from outside the state of Alaska and that their efforts accounted for 21 per cent of the salmon harvest. For the 1962, 1963, and 1964 seasons, nonresidents accounted for 13, 28, and 20 per cent of the total catch respectively. Compared to other Alaska regions, the Cook Inlet fisheries are resident oriented.

Table 11 relates fishing employment to volume and value of harvest. Annual income per fishermen figures (calculated by dividing the total value of harvest by the number of licenses) would give a misleading impression of the economic importance of fishing to fishermen. The use of man-months as the unit of measure in Table 11 corrects this impression, and indicates why individuals continue to fish commercially despite progressive shortening of seasons, the physical drop in size of salmon runs, and annual fluctuations. The value per man-month of salmon fishing effort in 1965-70 ranged from a high of $2,792 in 1968 to a low of $1,032 in the following year. The average for all of the six seasons of $1,868 is considerably greater than the man-month gross income yield of most alternative

TABLE 10

Cook Inlet Area—Monthly Fishing Employment*
Six-Year Average, 1965-1970

	Salmon (All Gear)				Crab (All Gear)			Shrimp (All Gear)
	Purse Seine	Beach Seine	Drift Net	Set Net	Dungeness	King	Tanner	
Jan.					**	31	6	2
Feb.					**	48	8	2
March					1	35	9	2
April					1	39	10	3
May					1	13	7	3
June	6		62	43	3	12	5	4
July	130	9	872	315	3	27	3	4
Aug.	99	2	141	187	5	81		4
Sept.	3		1	27	7	76		5
Oct.					4	48	4	6
Nov.					4	20	**	4
Dec.					**	29	3	5
12-Month Average	20	1	90	48	3	38	5	4

*Includes principal gear operator and all assistants engaged in fishing.
**Six-year average less than one fisherman.

SOURCE: Fisheries manpower study in progress, George W. Rogers, Richard F. Listowski, and Judith Brakel.

TABLE 11

Cook Inlet Fishing Effort Return, 1965-1970

Year	Total Man-Months of Employment	Average Pounds of Fish per Man-Month	Average Value To Fisherman per Mon-Month
SALMON			
1965	1.462	9.650	$1.713
1966	2.149	12.494	2.374
1967	1.760	8.280	1.669
1968	1.906	14.696	2.792
1969	1.864	4.896	1.032
1970	2.230	8.274	1.550
6-year average	1.895	9.772	$1.868
SHELLFISH			
1965	429	6.896	$ 809
1966	293	14.723	1.570
1967	509	7.609	734
1968	635	7.212	1.623
1969	821	7.592	1.257
1970	848	13.129	1.733
6-year average	589	9.361	$1.333

SOURCE: Fisheries manpower study in progress, G.W. Rogers, R.F. Listowski, and J. Brakel.

per man-month is slightly lower for shellfish, but, as noted, these fisheries provide virtually year-round employment.

These general findings are confirmed in the 1968 economic study of salmon cited earlier, although the study defined "fisherman" as only the principal operator of the gear and did not include assistants. Classified by the various forms of gear used by resident and nonresident license holders, salmon fishing in Cook Inlet on the average accounted for 49 to 67 per cent of total 1968 cash income of fishermen in each category. The effort to realize this return was concentrated within only 5 to 10 weeks, or 10 to 19 per cent of the total weeks in the year.[8]

Limited Entry Implications

These findings suggest why limited entry regulation raises such critical issues in the region. Fishing supplies an important part of the cash income of residents of the region, and it sustains the life style of the lower inlet, which also includes homesteading, subsistence hunting and fishing, and other part-time wage or salary employments. The cost of compensating these people for leaving the fishery will be relatively high. The other Alaska residents, principally the weekend and vacation fishermen from Kenai and Anchorage, have a lower economic stake in maintaining access to the fisheries; their exclusion would involve less personal sacrifice and loss to the region and the state. While they, too, would be expected to resist elimination, they probably could be "induced" to leave the fisheries at considerably less cost and effort than other inlet residents. The nonresident minority, like the first resident group, has a heavy stake in continuing participation, and a slight edge in terms of productivity and investment in vessels and gear, but they are also a traditional target for Alaska resident fishermen and politicians. If they could be discriminated against legally, the costs of their elimination could be "exported."

Putting the resident fishermen into the broader employment context of the region, economic and social hardship created by a strongly enforced limited entry program could be temporary. The regional economy has expanded (it boomed during the 1960's) as petroleum and other economic activities were added to what was formerly a dominantly fishing economy, and potential for further growth is present. Although the growth in alternative job opportunities has not yet had measureable effects upon fisheries employment, those fishermen eliminated might find employment in other industries within the region. Growth in the shellfish fisheries is very recent and could provide an alternative to the highly seasonal salmon fishing for those who wish to continue fishing. There is also, of course, the alternative of leaving the region and seeking employment elsewhere.

This is not to say that transfer of labor vocationally or geographically can be accomplished without hardship to individual families. Any attempt to limit entry will need to be accompanied by programs to assist in relocation and retraining as well as to compensate for economic loss suffered by the displaced fisherman. And the cost of such measures will have to be taken into account in any cost-benefit analysis of alternative management programs.

Another factor difficult to fit into the calculus is the optimum size and seasonal distribution of the fisheries labor force. No matter what its size, the required labor force will always be a highly seasonal one in salmon and only less so in other fisheries. A 1960-65 survey of the Cook Inlet salmon fishery noted, for example, that 69 per cent of the catch for the period was accounted for in two districts, and within these two districts, 60 per cent during only two or three 24-hour fishing periods per year at the peak of each run.[9] To further complicate calculations of labor force requirements, the different species of salmon run in cycles of varying lengths, and the annual prediction of volumes is still far from reliable. The seasonality and cyclical uncertainty of labor force requirements, therefore, means that there must always be times when more than enough fishermen are employed in order to assure that they will be available when the runs peak. Finally, the inlet "way of life," mentioned above, although beyond the scope of economic efficiency analysis, is integrally related to the harvest. Its preservation must be weighed in deciding who is to be eliminated from the fisheries.

Compared with other fisheries regions in Alaska, Cook Inlet might at first appear to be the region most readily adaptable to limited entry regulation because of the characteristics of its population and economy. A closer look at the nature of employment and labor force needs, however, suggests that measures of industry efficiency or productivity of fishing effort should not be taken as the final or only basis upon which management decisions are made.

THE BRISTOL BAY REGION

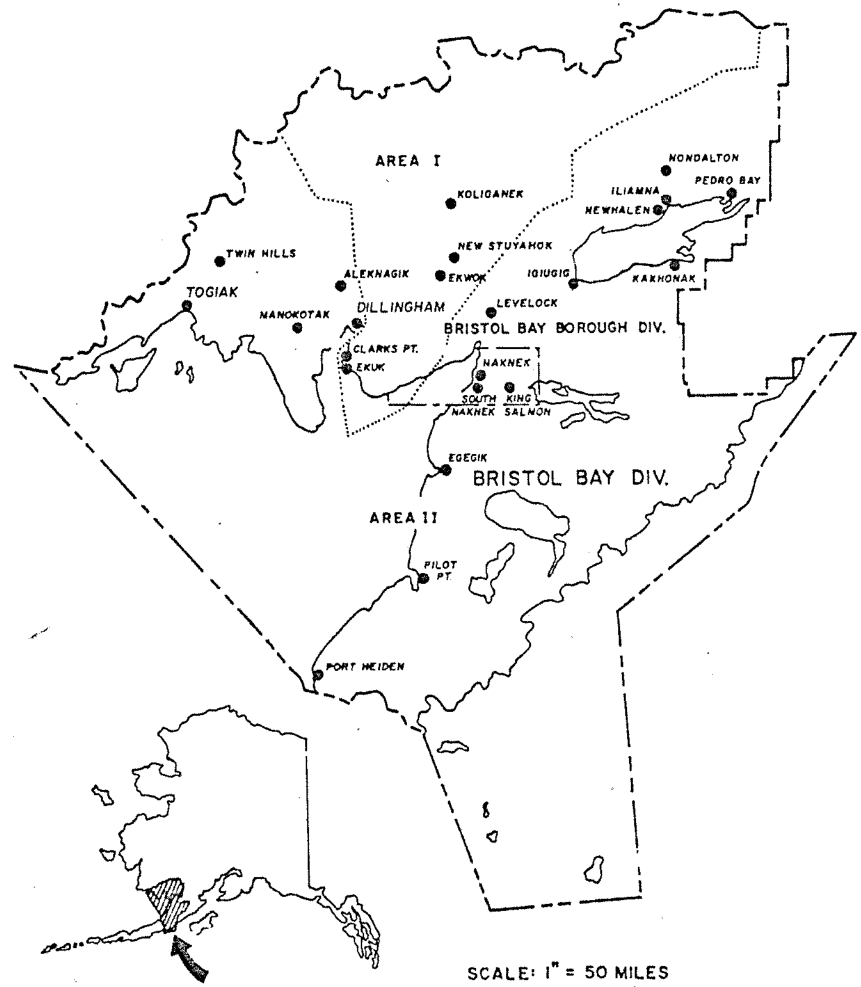
The Bristol Bay Region, Its Development and Population

Bristol Bay is a major indentation in the southern Bering Sea coast of Alaska. The region includes the drainages of the Togiak, Wood, Nushagak, Kvichak, Alagnak, and Naknek rivers and the north side of the Alaska Peninsula to Port Heiden. This analysis deals specifically with the area embraced by the Bristol Bay Borough (King Salmon, Naknek, and South Naknek) and the surrounding 1970 Bristol Bay Census Division (Figure 2).

In aboriginal times, the region was inhabited by four major Eskimo tribes living on salmon, sea mammals, and upriver land mammals. Fisheries and fur resources have been the source of income and employment in the region from the start of "historic time" until

Figure 2

Bristol Bay Region
(Places listed in 1970 Census.)



the present, though the economy now includes some defense and other government spending. The Wood and Nushagak rivers were prodigious breeding grounds for beaver, mink, and muskrat, and the fur trade was the first source of outside contact and commercial development.

Following construction of the first salmon cannery near the Moravian mission at Carmel in 1884, there was a rapid multiplication of plant and gear, but, until recently, this commercial growth and exploitation of the region's principal resource supported little permanent local economic activity. The total shore work force was initially made up of Chinese transported from San Francisco each season by sailing ships, which also brought cannery supplies, and these workers were returned there with the canned salmon pack at season's end. Fishermen were Italians and Scandinavians from California and the Pacific Northwest. It was not until the 1920's that residents began to become involved in the commercial fisheries. A 1939 study of employment and income in the region's salmon fisheries reported that, of 8,227 employed in the industry that year, 496 were Natives and 1,387 were non-Native residents of Alaska. No indication was given of how many of these Alaska residents were residents of the region.[10] Fifteen years later, another report stated that "of a total of about 6,000 men presently employed in the fishing industry in the Bristol Bay area, 4,000 are brought in from the United States; 1,000 are recruited from other parts of the Territory; and only 1,000 are provided locally."[11]

For the most part, the residents of the region have continued to follow a subsistence existence supplemented by cash income employment in commercial salmon fishing and by welfare. Other marine resources are abundantly present in the region, but exploitation of these has been minimal because of the remoteness of the region from markets and sources of supply. Fur harvests today are of minor importance. Tourism and outdoor recreation potential remain underdeveloped. There are some indications of mineral potential, with some petroleum exploration during the last decade, but development has been minor and sporadic. Earlier, World War II had brought the establishment of a permanent defense base at King Salmon near Naknek and temporary smaller stations elsewhere.

None of these developments brought any change in the basic transportation systems of the region beyond defense stimulated improvement in air service and some minor road extensions. There are plans for a ferry connection across Cook Inlet and a road across

Anchorage, but for the immediate future the region will remain an isolated and remote part of the state.

There have been significant shifts in the size and composition of the region's population since the end of the last century, although its present size is little more than it was 90 years ago (Table 12). The drop from the 1880 count of 4,010 persons to the 1920 count of 2,015 persons can be explained in part by the impact of imported diseases, including the post-World War I influenza epidemic, and the subsequent rise in population reflects the increasing effectiveness of public health programs. The jump between 1939 and 1950 represents the outside population introduced by World War II, the manning of the first defense station in the region, and the movement of Aleuts from the Aleutian Islands during this period. The increase in the last two decades is accounted for by increased defense staffing, government programs, and a dramatic rise in the rate of net natural increase in Native population.[12]

Although there has been a significant increase in non-Native population over the last two decades, the Native population still dominates. In the last pre-World War II census (1939), Natives represented 70 per cent of the population, and in 1970, they represented 64 per cent. General social and economic characteristics of the region's population indicate low average income levels and workforce participation (Table 13). Between 1960 and 1970, real income fell, and the percentage of families below the Alaska "poverty line" increased from 31 per cent in 1959 to 39 per cent in 1969. Although the infant mortality rate dropped from the 1960 level of 70.1 deaths per 1,000 live births to 29.4 in 1970, it still remains among the highest in the state, almost two and a half times the Cook Inlet rate.

The Bristol Bay Regional Economy

Aside from defense and other government spending, the region has virtually a single product economy. A range of fisheries products are now produced within the region, but the total value is still dominated by canned salmon. Of the total $48.7 million value of all 1970 fish products, the canned salmon pack alone accounted for $46 million, with red salmon accounting for 94 per cent of this value. Bristol Bay produced 37 per cent of the total state value of canned salmon in 1970. Much of this value leaves Alaska, however, in such forms as payments to nonresident workers, profits, and purchase of

TABLE 12

Bristol Bay Region*—Population Distribution, 1880-1970

	June 1, 1880	June 1, 1890	June 1, 1900[a]	Dec. 31, 1909	Jan. 1, 1920	Oct. 1, 1929	Oct. 1, 1939	Apr. 1, 1950	Apr. 1, 1960	Apr. 1, 1970
TOTAL REGION	4,010	2,726	3,400	2,271	2,015	2,198	1,992	2,756	4,024	4,632
Kvichak Bay - Port Heidon:										
Bristol Bay Borough[b]										
King Salmon AFS	–	–	–	–	–	–	–	100	322	403
Other places	192	93	431	150	111	173	306	274	618	744
Remainder of District										
Other defense stations	–	–	–	–	–	–	–	–	72	–
Other places	684	765	1,269	550	489	378	294	378	414	496
Subtotal	876	858	1,700	700	600	551	600	752	1,426	1,643
Nushagak Bay - Togiak Bay:										
Dillingham and vicinity	432	802	850	279	274	367	489	799	652	1,151
Other places	2,331	904	650	1,021	851	922	504	837	1,335	1,354
Subtotal	2,763	1,706	1,500	1,300	1,125	1,289	993	1,636	1,987	2,505
Iliamna District:										
Nondalton AFS	–	–	–	–	–	–	–	–	145	–
Other places	371	162	200	271	290	358	399	368	466	484

*Earlier data adjusted to represent same area as Bristol Bay Borough Census Division and Bristol Bay Census Division in 1970 census.

[a]Probably includes seasonal summer population and workforce.

[b]Does not appear until 1970 census. Earlier population represents same area.

SOURCE: U.S. Bureau of the Census.

TABLE 13

General Social and Economic Characteristics of Population, Bristol Bay Region, 1960, 1970

	April 1, 1960	April 1, 19'
Total Population	4,024	4,632
Native	2,534	2,949
Non-native	1,490	1,683
Family Income and Poverty Status[a]		
Median income, all families with income	$5,955	$7,284
(Deflated by BLS Consumer Price Index, 1957-59 = 100)	(5,776)	(5,384
Percent of families with:		
income less than poverty level	21.1%	29.5
income less than 75% poverty level	14.6	23.7
income less than 125% poverty level	30.8	39.0
income *more* than 125% poverty level	69.2	61.0
Educational Attainment (persons 25 years old and over):		
Median years completed:		
males	8.7	9.7
females	5.2	7.3
Percentage high school graduates:		
males	34.1%	45.6
females	26.1	33.4
Infant Mortality Rates (deaths under 1 year of age per 1,000 live births):	70.1	29.4
Weeks Worked in 1969:		
Percentage male population 16 years and over:		
50-52 weeks		39.1
27-49 weeks		15.7
26 weeks or less		37.2
did not work		8.0
Percentage female population 16 years and over:		
50-52 weeks		12.4
27-49 weeks		10.3
26 weeks or less		40.1
did not work		37.2
Labor mobility of males[b]		
Percentage of males 30-49 years old in 1970:		
nonworker 1965, nonworker 1970		30.1
nonworker 1965, worker 1970		6.5
worker 1965, worker 1970		57.0
worker 1965, nonworker 1970		6.4

[a]Excludes inmates of institutions, members of Armed Forces, colleg students in dorms and unrelated individuals under 14 years. 1970 poverty leve for all families = $3,388. For 1960 poverty level, all families = $3,000.

[b]"Worker" includes members of Armed Forces.

SOURCE: U.S. Bureau of the Census 1970: PC(1)-C3, Alaska; 1960: PC(1)-3C Alaska. Infant mortality data from Alaska Department of Healtl

The total structure and functioning of the regional economy is more effectively represented in annual employment data (which include the regular seasonal nonresident workers) summarized in Table 14, and in monthly employment data for 1965 and 1970 presented in tables 15 and 16. The economy is an extremely simple one: a basic sector consisting of commodity production based upon fishing and fish processing and a minor government element, and a relatively minor distributive indistries sector. Not reflected in any of these data are the important subsistence activities and transfer payments.

The Bristol Bay Commercial Fisheries and Fish Processing Industry[13]

The history of the Bristol Bay salmon fishery has been a pattern of boom, bust, and modest recovery typical of all Alaska fishing regions. From an annual average catch of four million fish for 1893-1900, the harvest rose to an average of twelve million for 1900-04, and with cyclical fluctuations, to an annual average of nineteen million fish for 1934-38. After that peak, there was a precipitous decline, but research and improved management programs in the 1950's led to a recovered annual average catch of nine million fish for the 1960's.

The historical development of the fisheries and processing industry reflects that Bristol Bay was and still is the most remote and isolated of Alaska's major fishing areas. The number of firms has remained relatively small, and their ownership or control has extended from the shore plant to fishing vessels and gear, and has also included transport systems to and from the region.

With a labor force reservoir of Orientals and European immigrants in California, it was easier and more economical to assemble harvesting, transporting, and processing crews outside Alaska than it was to attempt to recruit and train the scattered Native population. As late as 1939, of all wages and other payments made in this fishery, nonresidents collected 77 per cent of which 84 per cent was paid outside Alaska after the workers returned to their home bases.

The harvesting technology was simple. Fish traps had been eliminated from Bristol Bay fisheries by 1923. The dominant gear was the drift-gill net—each unit consisting of an open, double-ended

TABLE 14

Bristol Bay Region—Population, Employment by Industry—1961-1970

(12-Month Averages)

	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
al Population	4,476	4,382	4,734	4,355	4,423	4,552	4,920	4,970	5,040	4,632
al Employment	2,072	1,845	1,850	1,847	2,058	2,078	1,916	1,972	2,128	2,240
rticipation rate (%)	46.3	42.1	39.1	42.4	46.5	45.7	45.6	39.7	42.2	48.4
ernment										
deral: military[a]	540	540	540	540	410	430	530	480	470	400
civilian	150	170	180	185	190	179	167	166	146	160
ate and Local	80	80	90	90	100	130	150	174	190	210
Subtotal	770	790	810	815	700	739	847	820	806	770
mmodity Producing Industries										
shing[b]	500	430	400	420	440	500	420	450	520	460
od processing	525	370	382	334	626	515	371	395	505	680
her[c]	15	20	20	20	23	25	15	30	30	20
Subtotal	1,040	820	802	774	1,089	1,040	806	875	1,028	1,160

Table 14 (Continued)

Bristol Bay Region—Population, Employment by Industry—1961-1970

	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
	(12-Month Averages)									
utive Industries										
portation, commu- tions, utilities	65	67	68	73	89	94	95	113	117	110
es and other	39	34	28	24	29	28	30	35	42	50
	28	24	22	31	31	27	38	29	25	40
btotal	132	125	118	128	149	149	163	177	184	200
ified Employment[d]	130	110	120	130	120	150	100	100	110	110

Military personnel stationed in area as of July 1 (Alaska Command).

ncludes self-employed and family workers engaged in fishing (commercial).

Mining, construction, and other manufacturing combined to avoid disclosure in sources.

Other self-employed and family workers estimated by Alaska Department of Labor. Does not include persons engaged tence hunting and fishing.

E: Military from Alaska Department of Labor, *Current Population Estimates by Election Districts, Alaska*, published annually. Fishing employment from study of commercial fisheries employment by G.W. Rogers, R. Listowski, and J. Brakel for U.S. Department of Commerce. All others from Alaska Department of Labor, *Alaska Workforce Estimates by Industry and Area*, published annually, and office records.

TABLE 15

Bristol Bay Employment by Industry, 1965

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	12-Month ave.
l Employment	820	850	850	920	1,360	4,780	7,510	2,730	1,320	1,280	1,120	1,050	2,050
ernment													
deral: Military[a]	410	410	410	410	410	410	410	410	410	410	410	410	410
Civilian	180	170	180	180	180	200	190	200	200	190	190	200	190
ate and Local	60	90	90	80	90	110	140	140	100	90	100	90	100
Subtotal	650	670	680	670	680	710	740	750	710	690	700	700	700
nmodity-Producing ustries													
ommercial Fishing	--	--	--	--	10	2,050	3,180	30	--	--	--	--	440
ining (includes l and gas),										10			b
ontract Construction	10	--	--	--	--	--	10	20	50	50	50	10	20
ood Processing	10	20	10	50	420	1,600	2,970	1,510	290	300	180	150	620
Subtotal	20	20	10	50	430	3,650	6,160	1,560	340	360	230	160	1,080

Table 15 (Continued)

Bristol Bay Employment by Industry, 1965

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	12-Month ave.
butive Industries													
ısportatioı, Commu-													
tion, Public Utilities	80	80	80	100	90	100	110	100	100	80	70	80	90
ìe	20	30	30	30	30	30	30	30	40	30	30	30	30
ınce, Insurance,													
Real Estate						10	10	10	10				b
ices[c]	10	10	10	20	30	50	80	60	40	30	20	20	30
ubtotal	110	120	120	150	150	190	230	200	190	140	120	130	150
ːmployed and Unpaid													
y Workers	40	40	40	50	100	230	380	220	80	90	70	60	120

[a]Military personnel stationed in area as of July 1 (Alaska Command).

[b]Combined in total to avoid disclosure of firm data.

[c]Includes domestics.

;OURCE: Military from Alaska Department of Labor, *Current Population Estimates by Election Districts, Alaska*, published annually. Fishing employment from study of commercial fisheries employment by G.W. Rogers, R. Listowski, and J. Brakel for U.S. Department of Commerce. All others from Alaska Department of Labor, *Alaska Workforce Estimates, by Industry and Area*, published annually, and office records.

TABLE 16

Bristol Bay Employment by Industry, 1970

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	12-Month ave.
Employment	1,060	1,060	1,080	1,250	1,700	4,880	7,770	2,660	1,640	1,200	1,170	1,170	2,240
rnment													
leral: Military[a]	400	400	400	400	400	400	400	400	400	400	400	400	400
Civilian	150	140	150	130	120	140	250	250	260	110	120	120	160
te and Local	180	190	190	200	200	210	200	200	210	220	220	220	210
Subtotal	730	730	740	730	720	750	850	850	870	730	740	740	770
modity-Producing													
stries													
nmercial Fishing	--	--	--	--	80	2,240	2,980	150	--	--	--	--	460
ing (includes													
and gas)													b
itract Construction										10	10	10	b
od Processing	110	110	120	270	580	1,470	3,320	1,260	410	210	180	170	680
Subtotal	110	110	120	210	660	3,710	6,300	1,410	410	220	180	180	1,160

Table 16 (Continued)

Bristol Bay Employment by Industry, 1970

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	12-Month ave.
butive Industries													
nsportation, Commu-tion, and Public Utilities	100	100	100	100	130	140	140	130	130	100	100	90	110
le	50	56	40	40	50	50	30	40	80	40	40	50	50
nce, Insurance, Real Estate	--	--	--	30	20	30	40	30	30	30	30	30	20
ices[c]	10	10	20	20	20	30	60	30	20	20	20	20	20
ubtotal	160	160	160	190	220	250	270	230	260	190	190	190	200
ssified Employment													
-Employed and Unpaid ily Workers	60	60	60	60	100	170	350	170	100	60	60	60	110

[a]Military personnel stationed in area as of July 1 (Alaska Command).

[b]Combined in total to avoid disclosure of firm data.

[c]Includes domestics.

RCE: Military from Alaska Department of Labor, *Current Population Estimates by Election Districts, Alaska*, published annually. Fishing employment from study of commercial fisheries employment by G.W. Rogers, R. Listowski, and J. Brakel for U.S. Department of Commerce. All others from Alaska Department of Labor, *Alaska Workforce Estimates, by Industry and Area*, published annually, and office records.

more than 10 per cent of the total catch. The prinicpal fisheries management policy prior to World War II was simply to prohibit the use of motors in fishing vessels and to force them to fish far offshore, thus imposing gross inefficiency on harvesting activities in the interest of conservation.[14] Prior to the 1940's, all the catch was canned. With the continuing decline in fish runs following the peak catches of the 1930's, the industry consolidated into about half a dozen firms and entry of new firms was minimal.

World War II had important impacts on the fishery. War manpower restrictions drastically curtailed the number of fishermen, while price inflation and relaxed regulation intensified the fishing effort. This resulted in an abnormally high catch per unit in the period 1942-45 and provided a strong case for the logic of limited entry. The war-induced labor shortage also, for the first time, turned the industry to the use of resident labor in substantial numbers. An intensive recruitment and transportation program supported by the Bureau of Indian Affairs in cooperation with industry drew Native Alaskans into the labor force from as far north as Point Hope and as far east as Minto. Although attempts were made after World War II to revert to the practice of importing most of the labor force, a resident fishermen union and other institutional forces prevented this. With plant consolidation, canneries also began relinquishing ownership of boats and gear to individual fishermen.

The relaxation of regulations during the war period to permit the use of motor powered auxiliary vessels (to tow sail boats to and from the grounds, etc.) ultimately led to the complete removal of this irrational restriction. The shift of boats from sail to power was accomplished over a period of years; in 1951, of the 717 boats fishing, only 86 had converted to power, but by 1954, of the 712 fishing, 697 were powered. This was accomplished initially by conversion of sail boats to power, then progressive replacement by specially designed and built power craft.

Table 17 summarizes the total salmon catch (in pounds) and value to fishermen for 1960-70. The catch is dominated by the red or sockeye salmon, which accounted for 86 per cent of the total for the period, and imposed its particular biological cycle on the pattern of the total catch over time. The introduction of some freezer capacity during and after the war (initially, infrequent visits from floating freezers), air lift of fresh fish to Anchorage and other outside markets, Japanese demand for salmon and herring eggs, and sporadic

TABLE 17

Bristol Bay Salmon Catch* and Value to Fishermen, 1960-1970

	Pounds	Value to Fishermen
1960	78,712,574	$14,253,471
1961	77,052,410	12,643,634
1962	35,463,811	5,770,382
1963	18,369,937	3,168,970
1964	41,533,243	7,351,301
1965	112,715,000	23,775,885
1966	68,884,072	11,807,385
1967	33,363,905	5,817,149
1968	26,485,303	5,595,575
1969	46,827,723	10,811,624
1970	116,440,704	27,028,586

*Harvest in other fisheries of minor importance. Since 1966, there have been annual catches of herring and herring eggs and intermittent catches of lake trout and northern pike. Total value all other fish in 1970, however, was only $20,294.

SOURCE: Alaska Department of Fish and Game.

attempts to market bottom and lake fish have added variety to the list of products from the region, but the values of these new products have remained low (Table 18).

The Commercial Fisherman

Bristol Bay fishing employment estimates by type of gear and month are summarized in Table 19 for the period 1965-70. The salmon runs are concentrated in July, when the main red runs appear, while the runs of other species of lesser value extend into August. For most fishermen, this is the extent of their annual employment.

Set nets account for almost half the total employment in fishing, but less than 10 per cent of catch. Table 20 summarizes

TABLE 18

1970 Bristol Bay Fish Products and Wholesale Value by Species and Type of Product

	Pounds	Wholesale Value	Wholesale Value/lb.
SALMON			
Fresh	170,193	$151,229	$ 0.89
Frozen	4,921,675	2,030,153	0.41
Cured:			
Salmon	251,767	162,646	0.65
Salmon eggs	531,256	470,938	
Canned	58,219,392	45,915,431	0.79
Subtotal	64,094,283	$48,727,397	$ 0.76
OTHER FISH			
Cured herring	6,860	1,509	
Herring eggs on kelp	33,520	13,408	
Subtotal	40,380	14.917	0.37
Total All Products	64,134,663	$48,742,314	$ 0.76

SOURCE: Alaska Department of Fish and Game.

TABLE 19

Bristol Bay Area—Monthly Fishing Employment—Six-Year Averages, 1965-1970

	SALMON (All Species)		
	Drift Net	Set Net	Total Fishermen
May	4	1	5
June	713	262	975
July	2,715	1,133	3,848
August	156	81	237
September	3	8	11
12-Month Average	300	124	424

SOURCE: Fisheries harvesting manpower study in progress, George W. Rogers, Richard F. Listowski, and Judith Brakel.

TABLE 20

Bristol Bay Salmon Fishing Effort Return, 1965-1970

Year	Total Man-Months of Employment	Pounds of Fish per Man-Month	Value to Fisherman per Man-Month
DRIFT NETS			
1965	3,551	28,566	$6,026
1966	3,814	18,061	3,096
1967	2,926	11,403	1,988
1968	3,542	7,477	1,580
1969	4,056	11,545	2,666
1970	3,944	27,520	6,388
6-year average	3,639	16,855	$3,886
SET NETS			
1965	1,715	6,572	$1,386
1966	1,649	4,177	716
1967	1,222	2,730	476
1968	1,116	2,373	501
1969	1,745	2,684	620
1970	1,511	5,230	1,214
6-year average	1,493	4,100	$ 850

SOURCE: Fisherman manpower study in progress, G.W. Rogers, R. Listowski, and J. Brakel.

estimates of the yield per unit of effort (man-month) for the two forms of gear. Two high cycles of reds were present in the 1965-70 period, boosting the average value of catch of drift netters to more than $6,000 per man-month in these years. Even the off-years provided higher value per man-month than the Cook Inlet and other Alaska salmon fisheries (compare with Table 11, above). This, together with the prolific peak years, accounts for the tenacity of the Bristol Bay fisherman in sticking with his career through thick and thin. The yield and value per man-month for set netters is only a fraction of that for drift netters, but set netting is less demanding and is essentially a part-time activity often engaged in by members of fishermen's families.

A study of wage and employment conditions in 1939 (the last "normal" pre-World War II season) and a preliminary report of a

1970 survey of gear fished by residency provide two bench marks for describing Bristol Bay fishermen.[15] These are compared in Table 21. The two major changes over time have been the increase in the number of resident fishermen (from 1,285 in 1939 to 3,174 in 1970, as compared with the minor increase in nonresidents from 1,525 to 1,732) and the differential increases in average "real" value of the catch per fisherman (a 69 per cent increase for residents as compared with a 202 per cent increase for nonresidents).

On the other hand, the most important "constant" has been the substantially higher catch of nonresident fishermen (2.3 times the resident catch in 1939 and 2.1 times the resident catch in 1970). The reasons for this difference in performance were stated by the Department of Fish and Game area biologist who conducted the 1970 survey:

> Most of the non-resident fishermen are high-liners, that is, they consistently make large catches and are able to do so due to better gear and boats than possessed by many resident fishermen. A non-resident who comes all the way up from outside is going to fish pretty hard. Many of these fishermen have fished Bristol Bay for many years. On the other hand there are about three major groups of resident fishermen: (1) the highliner—who consistently make good catches and can and do compete with the non-resident; (2) the part-time or weekend fishermen who cannot compete. Most of these vacation fishermen use either skiffs and/or older gear and vessels which cannot compete with the larger mobile highliner fleet; (3) the last group of resident fishermen are the upriver native fishermen—they largely cannot compete due to inadequate vessels . . . Further, these upriver fishermen have an entirely different approach to fishing as a livelihood. They normally catch just what they need to get through the next season. I've seen lots of cases here on the Nushagak where they go back up-river after red season with 5,000 to 8,000 fish, and if they had stayed for pink season could have caught another 5,000 to 15,000 fish.[16]

One reason for the behavior of this last group may be found in the desire to continue their traditional subsistence economies. Commercial fishing may provide their principal source of cash, but subsistence fishing and hunting upriver or on the lakes still contributes an important part of the family diet.

Further characteristics of the resident fishermen in the region are available from a Department of Labor survey made in April 1970 of persons 16 years and over living in Alaska villages. The data were

TABLE 21

Bristol Bay Samon Fisheries—Catch and Value by Residence of Fishermen, 1939, 1970

	1939	1970
Number of Fishermen Engaged:		
Resident	1,285	3,174
Nonresident[a]	1,525	1,732
Total	2,810	4,906
Value to Fishermen (Wages paid and/or sales)		
Resident	$ 983,461	$12,453,147
Nonresident	1,522,663	14,575,439
Total	$2,506,124	$27,028,586
Thousands of Salmon Caught:		
Resident	4,009	10,160
Nonresident	11,178	11,891
Total	15,187	22,051
Average Value per Fisherman:		
Resident	$765	$3,923
Nonresident	998	8,415
Total	$892	$5,509
Average "Real" Value per Fisherman:[b]		
Resident	$1,580	$2,678
Nonresident	2,061	6,220
Total	$1,843	$4,072
Average Catch per Fisherman (Number of fish)		
Resident	3,120	3,201
Nonresident	7,330	6,866
Total	5,405	4,495

[a]Includes 94 unallocated fishermen.

[b]Deflator used, *Consumer Price Index*, Bureau of Labor Statistics, 1957-59 = 100.

SOURCE: 1939: Special study of wage and employment conditions in Alaska salmon industry by Alaska Planning Council, published in Ward T. Bower, *Alaska Fishery and Fur-Seal Industries, 1939*, U.S. Department of Interior, Administrative Report No. 40 (1941), pp. 142-145. 1970: from analysis of gear license and fish ticket records, Michael L. Nelson, "1970 Bristol Bay Salmon Catch by Residency," Alaska Department of Fish and Game, April 2, 1971. Fishermen employment estimated at two per drift net and two and a half (2.5) per set net.

collected on 585 persons, 16 years and over, residing in 21 communities in the Bristol Bay region. Because of the purposes of the survey, it could be assumed that these are Native villagers. From these records, a selection was made of 195 persons who were judged to be regularly engaged in commercial fishing as an important rather than an incidental occupation. The total of 195 records examined consisted of 151 males and 44 females (family workers or members of husband and wife teams). Fishing was listed as the primary or "most important occupation" by 114 persons, 31 listed service, clerical and professional as their primary occupation, 7 indicated food processing, and the remaining 43 specified various manual trades. The average earnings for 1969 from all sources (not just fishing) was less than $3,000 for 117, between $4,000 and $5,999 for 40, and over $6,000 for 38. Of the males, 42 had no dependents, 20 had two or less, and 89 had three or more dependents. Of females, who were asked how many children they had at home, 4 had none, 16 had one or two, and 24 had three or more children.

In sum, of the resident fishermen sample represented by these data, 58 per cent considered commercial fishing their only or primary occupation, 60 per cent earned less than $3,000 per year from *all* sources and only 24 per cent had *no* dependents. Despite these conditions, only 18 per cent of those surveyed indicated that they would be willing to move permanently from the region if offered employment, although slightly more would consider temporary employment outside the region or would move temporarily for training.[17]

Limited Entry Implications

Limited entry regulations in the Bristol Bay fisheries would have critical impacts on two contrasting groups of fishermen. The high-liners, mostly nonresidents, are consistently high producers and own the most efficient vessels and gear. To reduce their numbers would be to lessen the economic efficiency of the harvesting effort. On the other hand, the majority of the resident fishermen, who have the less efficient gear and boats and who must respond to other seasonal demands, are heavily dependent upon fishing for their basic survival.

Unlike Cook Inlet, there are no prospects in the Bristol Bay region of immediate or future employment opportunities outside of move either geographically or vocationally. Consequently, their elimination from the harvesting labor force would result in increased regional social costs in the form of higher welfare payments and social and individual disintegration. On the other hand, a carefully programmed implementation of limited entry over a sufficiently long period of time, coordinated with programs of relocation and retraining, could be a means for improving the economic well-being of the residents of a region with the lowest standards of living in the state. Fisheries management in Bristol Bay, therefore, cannot be considered apart from the region and its residents and must include economic welfare in its calculus. With the recent emergence of a strong Native political movement in Alaska, moreover, policy makers will not be allowed to overlook these elements.

Economic Efficiency Implications of Seasonality

Faced with the results of a poor 1972 salmon run, the president of the Bristol Bay Native Corporation commented:

> As this disastrous fishing season draws to a dreary close, many of our local resident fishermen will be standing by, watching outsiders earning a living at their doorstep. . . . Is there anything we can do to provide better protection for the resident fishermen of Bristol Bay, who must fish their waters along with so many others who leave right after the fishing season? Can't we make more jobs available to local people so that they can earn money close to where they live?[18]

An affirmative answer can be given to this question, and the answer need not be contrary to biological and economic efficiency standards as calculated by use of bio-economic models. In the application of their model to the Bristol Bay fishery, Crutchfield and Pontecorvo used the following approach to calculating the economic rent dissipated each season:

> The prime requirement is that a base period be available from which relative efficiency in the fishery at other times may be measured; hence, a period in which amounts of imputs, location of fishing effort, and the rate of fishing approximate those that would yield maximum efficiency in the fishery. The years 1942 and 1943 provide an approximation of such a base for analysis of the Bristol Bay Fishery. In those years Bristol Bay was in a war zone, . . . The impact of the restriction on entry and permission to fish closer inshore is reflected in the very sharp increase in yields per unit of input during this base period. If we assume, first, that the yields per unit of input obtained in 1942 and 1943 represent an approximation of

There were two important points not commented upon in the analysis from which this quotation is drawn. The first is that not only was the war period a time of man-power restriction which imposed an effective form of limited entry on the fisheries, it was also a time when travel and other restrictions substantially reduced nonresident participation. This base period approximation of maximum efficiency was used in computing the relative efficiency of all other periods, and the periods of highest efficiency over the 1934-49 period studied (1940-44 and 1945-49) were also the times that Natives were recruited from all over Alaska (many with no fishing experience) to meet the fish harvesting workforce needs. Thus, not only efficiency, but also resident participation was at its highest. To answer the question raised above, then, experience has demonstrated that "preferential" hiring of residents does not reduce the efficiency of the harvesting effort. (Using the justification in Crutchfield and Pontecorvo, we might even argue that experience demonstrates that residents increase efficiency.)

The second point is that the gear used during the base period was the inefficient and dangerous two-man double-ended open sailing boat, and the nets and hauling techniques were far less efficient than those in use today. The explanation of this second paradox is simply that factors were given the wrong weights in accounting for the rise in efficiency in 1942-43. Limited entry alone was not the answer and efficiency of gear was not high. Perhaps of greater importance than both of these factors was the relaxation of regulation to allow fishing closer to the mouths of the rivers, where the salmon schools are at their maximum density before moving upstream.

There remains to be answered the generalization quoted above that Native fishermen do not fish the whole season, but only hit the peak and return upriver when they have caught the amount needed to meet their annual cash income requirements. In terms of productivity per unit for the season, therefore, the Native fisherman is given a low rating. Again, the approach used by Crutchfield and Pontecorvo in calculating the economic efficiency each season does not cover this dimension (the seasonal fluctuation in participation):

> The calculation of the amount of rent that is dissipated is as follows. The gross earnings of the factors used in each year are known. These are simply the price of fish times the number caught (Bristol Bay fishermen are paid on a per fish basis) or total gross revenue of the fleet. We also know for each year the efficiency, relative to the 1942-43 base, of the fishing fleet

> basis of 1942-43 yields, the minimum quantity of inputs needed to harvest the number of fish actually caught in any given year. Given the number of units actually required in terms of 1942-43 yields and the assumption of opportunity factor incomes, the difference between the gross earnings of the entire fleet in any year and the gross earnings that would have been required if this fleet had been limited in number and operating at the 1942-43 efficiency level, provides a measure of the potential rent.... The gross earnings ... [that] were not actually necessary to catch the given year's landings represent the amount of the rent lost in that year.[20]

These calculations are made only in terms of *total* number of units engaged each year (fathoms of net, number of boats, number of men), *total* catch, and *total* annual gross revenues. In a footnote to this quotation, the authors do call attention to the extreme seasonality of the fishery and suggest an alternative calculation might be made on yields per boat per day, but they immediately attempt to cancel out the effect of this important characteristic of the fishery upon economic efficiency:

> If we take the highs, that is those days when the boats were landing at or close to the peak number of fish, we also have a rough measure of *minimum required capacity of the fleet.* These yields divided into the total catch should give us a measure of the number of boats required to land the entire catch and this measure should be consistent with the measure we have derived in the calculation given previously. (Italics added.)[21]

The *minimum* capacity required, therefore, is that required to harvest the peak of the run, which means that for the rest of the run there will be overcapacity. By participating primarily in this peak period of the run, the upriver Natives actually reduce this hidden element of economic inefficiency by reducing the presence of seasonal overcapacity. Thus, if the basis of comparison between groups of fishermen were on a per day basis rather than on a total season basis, their relative productivity would not appear as divergent as that registered in measures commonly used. This represents a further important shortcoming of the bio-economic models currently proposed as policy guides. In fact, the calculations of yield and revenue per man-month used in tables 11 and 20 above suggest substantially lower dissipation of "economic rent" than is calculated by Crutchfield and Pontecorvo based on total units engaged (or the alternative of the peak units engaged) and total yield and revenues.

Crutchfield has already pointed out the limitations of proposed

fisheries regulation. This present essay suggests that other models can and should be devised to deal with these important elements of policy, and that they take into account the regional setting of the fishery and the economic and social characteristics of the fishermen. This discussion has also pointed out, however, that, even in the area of economic efficiency, the bio-economic models presently proposed by economists have serious limitations because of the factors left out of their abstractions of the working of the economic system. Beyond all of this, consideration of policy must be carried out in terms of "ultimate goals" of the most productive use of the resource, which is not bound simply by the logic of biology and an abstract generalization of economic efficiency.

NOTES

[1]J.S. Crutchfield, "Economic Aspects of Fisheries Management," above.

[2]*Ibid.*

[3]See, above, "Politics and Management: The Problem of Limited Entry," by Thomas A. Morehouse and Jack Hession.

[4]Alaska Department of Fish and Game, "Proposal for Funding Alaska Department of Fish and Game Member of Governor's Select Committee on Limited Entry," (xeroxed typedscript), Juneau, Alaska, April 1972, pp. 3-4.

[5]J. Rearden, *Status of the Cook Inlet-Resurrection Bay Commercial Salmon Fishery, 1965*, Information Leaflet 69, Alaska Department of Fish and Game, October 14, 1965.

L.B. Flagg, *An Economic Survey of the Cook Inlet Salmon Fishery, 1968*, Information Leaflet 145, Alaska Department of Fish and Game, June 1, 1970. Historical and statistical data on other fisheries based on notes provided by Don Stewart, management biologist, Homer, and annual commercial fisheries statistics of the Alaska Department of Fish and Game.

[6]This discussion based upon findings in L.S. Flagg, *op. cit.* for the 1968 season and worksheets in a study in progress of Alaska commercial fishermen for 1965-70 is being conducted by George W. Rogers, Richard F. Listowski, and Judith Brakel.

[7]Net income data were not available at the time of this writing. Except for the larger vessel owners, however, the average fisherman thinks in terms of what he grosses, and lumps his operating expenses with his general living expenses. The boat is a seasonal and, in some cases, a year-round home.

[8]L.B. Flagg, *op. cit.* p. 14.

[9]. Rearden, *op. cit* p. 2.

[10]Reported in Ward T. Bower, *Alaska Fishery and Fur-Seal Industries in 1939*, Bureau of Fisheries Administrative Report No. 40, U.S. Department of the Interior, 1941, pp. 142-145. This report also indicated that 84 per cent of wage payments to nonresidents were made *outside* Alaska.

[11]Corps of Engineers, *Southwestern Alaska*, Interim Report No. 5, January 20, 1954, p. 35.

[12]George W. Rogers, "Alaska Native Population Trends and Vital Statistics, 1950-1955," *ISEGR Research Note*, University of Alaska, Fairbanks, November 1971.
Dorothy C. Jones, "Changes in Population Structure in the Aleutian Islands," *ISEGR Research Note*, University of Alaska, Fairbanks, December 1970.

[13]Alaska Department of Fish and Game, *Alaska Catch and Production, Commercial Fisheries Statistics* (annual).
George W. Rogers, *Preliminary Economic Survey of Dillingham, Alaska and the Bristol Bay Region*, (mimeograph) Alaska Rural Development Board, Juneau, Alaska, August 1, 1955.
R.A. Cooley, *Politics and Conservation: The Decline of the Alaska Salmon*, New York: Harper & Row, 1963).
J.A. Crutchfield and G. Pontecorvo, *The Pacific Salmon Fisheries: A Study in Irrational Conservation*, (Baltimore: The Johns Hopkins Press, 1969) pp. 104-122.

[14]The offshore fishing was justified as a means of providing a random escapement of races of salmon. The power prohibition was an example of use of inefficient gear as a means of assuring an adequate level of total escapement.

[15]Ward T. Bower, *loc. cit.*
Michael L. Nelson, "1970 Bristol Bay Salmon Catch by Residency," Memorandum, Alaska Departmen of Fish and Game, April 2, 1971.

[16]Nelson, *op. cit.*

[17]Data provided by Alaska Department of Labor from Applicant Characteristics Bank, Research and Analysis Section.

[18]*Anchorage Daily News*, July 21, 1972, "Bristol Bay's Bleak Outlook."

[19]J.A. Crutchfield and G. Pontecorvo, *op. cit.*, p. 113.

[20]*Ibid.*, pp. 113-114.

REFERENCES

Alaska Department of Fish and Game, *Alaska Catch and Production, Commercial Fisheries Statistics*, (annual).

———, "Proposal for Funding Alaska Department of Fish and Game Member of Governor's Select Committee on Limited Entry," (xeroxed typescript) Juneau, Alaska, April 1972.

Bower, Ward T., *Alaska Fishery and Fur-Seal Industries in 1939*, Bureau of Fisheries Administrative Report No. 40, U.S. Department of the Interior, 1941.

Cooley, R.A., *Politics and Conservation: The Decline of the Alaska Salmon*, New York: Harper and Row, 1963.

Crutchfield, J.A. and G. Pontecorvo, *The Pacific Salmon Fisheries: A Study in Irrational Conservation*, Baltimore: The Johns Hopkins Press, 1969.

Flagg, L.B., *An Economic Survey of the Cook Inlet Salmon Fishery, 1968*, Information Leaflet 145, Alaska Department of Fish and Game, June 1, 1970.

Jones, Dorothy C., "Changes in Population Structure in the Aleutian Islands," *ISEGR Research Note*, University of Alaska, Fairbanks, December 1970.

Nelson, Michael L., "1970 Bristol Bay Salmon Catch by Residency," Memorandum, Alaska Department of Fish and Game, April 2, 1971.

Reardon, J., *Status of the Cook Inlet-Resurrection Bay Commercial Salmon Fishery, 1965*, Information Leaflet 69, Alaska Department of Fish and Game, October 14, 1965.

Rogers, George W., "Alaska Native Population Trends and Vital Statistics, 1950-1985," *ISEGR Research Note*, University of Alaska, Fairbanks, November 1971.

———, *Preliminary Economic Survey of Dillingham, Alaska and the Bristol Bay Region*, (mimeograph) Alaska Rural Development Board, Juneau, Alaska, August 1, 1955.

U.S. Corps of Engineers, *Southwestern Alaska*, Interim Report No. 5, January 20, 1954.