

# Economic and Demographic Systems Analysis: Unalaska and Cold Bay, Alaska

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**ECONOMIC AND DEMOGRAPHIC SYSTEMS ANALYSIS:  
UNALASKA AND COLD BAY, ALASKA**

Final Technical Report

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Copies of the models described in the report may be obtained on diskettes from the Minerals Management Service.

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## Executive Summary

This report documents economic and demographic projection models for the communities of Unalaska and Cold Bay. The models were developed for in-house use by the Minerals Management Service (MMS) in analyzing potential employment and population impacts of OCS oil exploration and development supported out of these communities. The models are "worksheets" in the spreadsheet program LOTUS 1-2-3, and may be used on IBM compatible computers. Copies of the models may be obtained from the Minerals Management Service.

Data and assumptions in the report are based primarily on previous MMS studies. Sample model projections are presented in the report. Because of the uncertainty associated with developments in the fishing and transportation industries, these projections should be considered examples of possible versions of the future rather than as predictions of the future.

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## I. INTRODUCTION

This report documents economic and demographic projection models for the communities of Unalaska and Cold Bay for use in analyzing potential employment and population impacts of OCS oil exploration and development in the St. George and North Aleutian Basins. The models have been developed as "worksheets" in the spreadsheet program LOTUS 1-2-3 for in-house use by the Minerals Management Service (MMS). The models are available on floppy disks and may be used on IBM compatible computers. Copies of the models may be obtained from the Minerals Management Service.

Chapter II of the report describes the purpose of the Unalaska model and its structure. Chapter III provides an economic and demographic description of Unalaska, and documents the specific assumptions used in the model. Chapter IV describes Unalaska model base case projections. Chapter V describes the structure, assumptions, and projections of the Cold Bay model. The appendixes provide additional data as well as a complete listing of the models.

The community of Unalaska has been described in detail in several studies prepared for the Minerals Management Service's Social and Economic Studies Program. Recent studies include a June 1990 study by Northern Economics, *Commercial Fishing Industry of the Bering Sea* (Technical Report No. 138), and a 1987 study by Impact Assessment, *Analysis of Aleut Institutional Response and Change: 1980-1985* (Technical Report No. 128). This report makes extensive reference to these earlier studies. The purpose of the report is not to repeat or duplicate earlier descriptions of Unalaska, but rather to provide a brief description of the community together with comprehensive documentation of the model structure and assumptions.

The report also documents a model for Cold Bay. Because the community of Cold Bay is much smaller than Unalaska, the model is considerably simpler than the Unalaska model, and the description of the community is also briefer.

## II. STRUCTURE OF THE UNALASKA MODEL

The model which is documented in this report is a Lotus 1-2-3 worksheet. Rows in the worksheet represent different categories of employment or population, as well as ratios or "multipliers" between different categories of employment and population. Columns in the worksheet represent years. The worksheet includes both historical data (usually 1980-1989) as well as projections (1990-2010). Completing the model are macro commands which create several tables and graphs. Chapter III describes the historical data used in the model as well as the assumptions upon which the model projections are based. Chapter IV describes model projections for three different "cases" or scenarios for future employment and population in Unalaska.

### Purpose of the Model

The model was developed by the University of Alaska Institute of Social and Economic Research (ISER) for use by the Minerals Management Service (MMS) in projecting potential employment and population impacts of OCS development in the St. George and North Aleutian Basin leasing areas. The model is similar in structure to other models recently developed for MMS by ISER to project the impacts of lease sales on several southcentral Alaska coastal communities (see *Economic and Demographic Systems Analysis: Gulf of Alaska/Cook Inlet*, Technical Report No. 134, August 1989). The model is also similar in structure to an earlier model of Unalaska developed by ISER (see *St. George Basin and North Aleutian Basin Economic and Demographic Systems Impacts Analysis*, Technical Report No. 87, June 1984) although that model was not programmed in a Lotus 1-2-3 spreadsheet.

A common disadvantage of computer impact projection models is that the users may not understand how the projections are derived or what the key assumptions are. Alternatively, the user may understand the model structure but disagree with key model assumptions. The model presented in this report was developed with the purpose of making all of the model structure and all of the assumptions visible by looking at the worksheet,

and permitting model users to easily change any model assumptions in order to explore the effects of alternative assumptions.

### **Determinants of Model Structure**

The structure of the model results in part from the needs of the Minerals Management Service in preparing Environmental Impact Statements, as well as the limited data on and rapidly changing economic and demographic structure of the community of Unalaska.

Any economic and demographic projection model, whether it resides on the "back of an envelope" or a mainframe computer, is a structured set of assumptions about the future. Typically certain "driving" assumptions (e.g. expected levels of employment in basic industries) are combined with assumed economic and demographic relationships (e.g. economic multipliers) to derive projections for other variables. Sometimes these relationships are estimated using econometric techniques. However, if historical data are not available or if the economic structure of the community is changing rapidly, it may be necessary to assume relationships based on judgment.

Persons experienced with impact modeling have found that there is almost inevitably a trade-off between simplicity and complexity in model structure. The simpler a model, the easier it is to understand the model projections and to obtain the necessary data inputs, but the less "realistic" the model structure may be in depicting how different economic and demographic variables affect each other. The more complex a model, the better it may depict these economic and demographic relationships, but the more data are needed to "calibrate" the model, and the more assumptions must be made to "drive" the model projections.

The structure of the model presented in this report represents what we believe to be the best tradeoff between simplicity and complexity in meeting the needs of MMS for a model of Unalaska, based on our experience in preparing similar projection models in the past. The model projects a relatively small number of employment and population



variables. We believe the structure is as complex as can be justified, given data limitations, lack of information on key economic and demographic relationships, and uncertainty about key external factors affecting future basic industry development, in particular the Bering Sea fishing industry.

The sensitivity of the Unalaska economy to unpredictable changes within specific industries limits the confidence which can be placed in any particular forecast of future employment or population. Given this limitation, the model projections should not be viewed as predictions of the future, but rather as illustrations of possible versions of the future.

### Employment Categories

The measure of economic activity in the model is *annual average employment*. Because there are wide seasonal variations in employment in different industries, due to the seasonality of fish harvesting and processing, actual employment at any given time during a year may differ widely from annual average employment for that year.

The model distinguishes between twenty-three "categories" of employment. These categories differ with respect to one or more of four factors: industry, residency, sector and origin. These factors are listed in Table II.1, and are defined below.

*Industry* refers to the common definition of industry by type of activity (mining, construction, local government, etc.), as used in the Standard Industrial Code classifications. Most employment data are published by industry, including the Alaska Department of Labor employment data which are the primary source of data for the model.

*Residency* refers to the extent to which employees make their home within the community. "Resident" employees have their primary residence in the community and consider the community their home. "Enclave" employees work in the community, but live in self-sufficient camps or dormitories, at which they receive most of their food and other

**Table II.1: Factors Used to Distinguish Between Employment Categories in the Unalaska Model**

INDUSTRY	RESIDENCY
Fish Harvesting	Resident
Mining	Enclave
OCS	
Other Mining	
Construction	SECTOR
Manufacturing (fish processing)	Basic
Transportation, Communications and Utilities	Support
Wholesale Trade	Government
Retail Trade	
Finance, Insurance and Real Estate	Origin
Services	Exogenous
Miscellaneous	Endogenous
Federal Government	
State Government	
Local Government	

services. "Enclave" employees do not consider the community their home. Much of the fish processing employment in Unalaska may be characterized as "enclave." "Non-resident" employees are those who live elsewhere but pass through a community or who occasionally interact with the community, such as non-local fishermen making deliveries to processing plants in Unalaska, or construction workers working on short-term construction projects. The model does not attempt to project "non-resident" employment.

*Sector* is a term commonly used by economists to distinguish between primary activities involving direct production of goods (the "basic" sector), secondary activities supporting production or consumption (the "support" sector), and government (government is sometimes considered part of the support sector). Typically, activities such as fishing or manufacturing would be considered "basic" while activities such as retail trade or transportation would be considered "support."

*Origin* is a term which we use in this report to distinguish between exogenous and endogenous employment. "Exogenous" or externally-driven employment is determined by factors outside the community. Exogenous employment is not affected by changes in other employment or population in Unalaska. Fish processing provides an example of an exogenous industry. If employment in another industry, such as federal government, were

to rise, this would not result in an increase in fish harvesting employment.

In contrast, "endogenous" or internally-driven employment is determined by factors within the community. Endogenous employment is affected by changes in other employment or population within Unalaska. Local government and retail trade provide examples of industries which are partly endogenous. If employment in another industry, such as federal government, were to rise significantly, this would result in an increase in local government and retail employment.

In Unalaska, employment in a number of industries may be considered partially exogenous and partially endogenous. For example, transportation employment serves both local residents as well as the non-residents who fly to Unalaska to work as crew on fishing vessels. Thus transportation employment is both internally and externally driven.

Economists often use "sector" in the manner in which we use "origin" in categorizing employment. In a larger regional economy, most "basic" economic activities are usually considered "exogenous," and most "support" activities are usually considered "endogenous." However, in a small community such as Unalaska it is useful to distinguish between sector and origin, because much support activity is partially exogenous.

The twenty-three categories of employment used in the Unalaska model are listed in Table II.2, sorted according to industry. There are only two industries in which enclave employment occurs (OCS mining and fish processing). All "basic" employment is exogenous, as is federal and state employment. The model provides for both exogenous as well as endogenous shares of all "support" employment as well as local government employment. However, in practice, we assume that exogenous employment in some support industries and in local government is actually zero.

**Table II.2: Categories of Employment in the Unalaska Model**

INDUSTRY	SECTOR	RESIDENCY	ORIGIN
Fish harvesting	Basic	Resident	Exogenous
Mining: Non-OCS	Basic	Resident	Exogenous
Mining: OCS	Basic	Resident	Exogenous
Mining: OCS	Basic	Enclave	Exogenous
Construction	Support	Resident	Exogenous
Construction	Support	Resident	Endogenous
Manufacturing: Fish processing	Basic	Resident	Exogenous
Manufacturing: Fish processing	Basic	Enclave	Exogenous
Trans., Commun., and Util.	Support	Resident	Exogenous
Trans., Commun., and Util.	Support	Resident	Endogenous
Wholesale Trade	Support	Resident	Exogenous
Wholesale Trade	Support	Resident	Endogenous
Retail Trade	Support	Resident	Exogenous
Retail Trade	Support	Resident	Endogenous
Finance, Ins., & Real. Estate	Support	Resident	Exogenous
Finance, Ins., & Real. Estate	Support	Resident	Endogenous
Services	Support	Resident	Exogenous
Services	Support	Resident	Endogenous
Federal Government	Government	Resident	Exogenous
State Government	Government	Resident	Exogenous
Local Government	Government	Resident	Exogenous, OCS-driven
Local Government	Government	Resident	Exogenous, other exogenous
Local Government	Government	Resident	Endogenous

### Overview of Model Structure

The model provides employment and population figures for the years 1980 through 2010. In general, the figures for the years 1980 through 1989 are based upon historical data, while the figures for the years 1990 through 2010 are "projections." However, for some variables for which data were not available, the figures for years prior to 1990 were estimated.

## Historical Assumptions (1980-1989)

Table II.3 provides a simplified overview of the structure of the model. In developing the model, we began by estimating historical (1980-1989) exogenous and endogenous employment in each category as well as population. These historical estimates provided the basis for development of the relationships used in projecting future employment and population. Our historical employment estimates were based on unpublished Alaska Department of Labor (ADOL) data on employment by industry by year, provided to the Minerals Management Service. Our historical population estimates were based primarily on Alaska Department of Labor population estimates published in *Alaska Population Overview*.

Table II.3  
Structure of the Unalaska Model

Type of Variable	How Values for 1980-1989 are Derived	How Values for 1990-2010 are Derived
Exogenous employment	Estimated based on historical data	Assumed
Resident exogenous		
Enclave exogenous		
Endogenous employment	Estimated based on historical data	[Resident exogenous employment] x [Assumed resident employment multiplier] + [Enclave exogenous employment] x [Assumed enclave employment multiplier]
Resident population	Estimated as total population minus enclave employment	[Resident employment] x [Resident population multiplier]

After developing assumptions on historical employment by industry, we made further assumptions to divide employment within each industry into different categories, as listed in Table II.2. This involved making our best judgments as to residency and origin within each industry. In Chapter III, we describe our specific assumptions for each industry.

## Projections (1990-2010)

**Exogenous employment.** Next we made assumptions about future levels of exogenous employment, based on expected trends in factors such as Bering Sea fisheries harvests, allocation of harvests to onshore-processors, and OCS activity. We based these assumptions on earlier MMS studies and other studies, as well as discussions with local government officials. In order to examine different possible future scenarios for Unalaska, we made three different sets of assumptions about future exogenous employment: a "low case," a "medium case," and a "high case." These three sets of assumptions result in three different sets of projections, which are described in Chapter IV.

The exogenous employment assumptions are critical to the model for two reasons. First, exogenous employment represents more than half of total employment. Thus we directly assume more than half of our "projections." Secondly, our exogenous employment assumptions "drive" our projections for endogenous and government employment and population.

In Unalaska, exogenous employment is overwhelmingly fish processing. Technical Report No. 138, *Commercial Fishing Industry of the Bering Sea* (June 1990), provides a detailed analysis of the fish processing industry in Unalaska and factors affecting the future of the fish processing industry. Thus the most important exogenous employment assumptions used in the model are based on the analysis and projections in Technical Report No. 138.

**Endogenous employment.** Endogenous employment includes all or part of employment in eight industries: construction; transportation, communications and utilities; wholesale trade; retail trade; finance, insurance and real estate; services; miscellaneous; and local government. We project future endogenous employment in these industries by projecting future total endogenous employment and then dividing this total into the historical shares of endogenous employment for 1989.

We project total endogenous employment as follows. First, we divide total historical endogenous employment between "resident-generated" and "enclave-generated" endogenous employment. In order to do this, we assumed that resident employment has a relatively greater effect or "multiplier" in creating endogenous employment than does enclave employment, in part because residents spend a greater share of their income within the community. We assumed a constant ratio of 4:1 between the resident and enclave multipliers. This enabled us to estimate both "resident-generated" and "enclave-generated" historical endogenous employment, as well as historical exogenous employment multipliers for exogenous resident employment and exogenous enclave employment. We then used the estimated multipliers for 1989 to calculate future endogenous employment. These calculations are most easily understood by studying the formulas in the model worksheet.

**Population.** Finally, the model projects resident population as proportional to resident employment. In general, we believe it is likely that the ratio of population to total employment will remain roughly constant. However, during short-term periods of boom or bust, this assumption may overstate or understate the actual population which will occur, as population does not adjust immediately in proportion to employment.

We recognize that in the real world, a great variety of economic, demographic, cultural and social factors determine the population of a community. Although population is ultimately linked to the economic base of a community, many other factors come into play, such as birth and death rates, and the strength of cultural and family ties to the community. However, it was not possible to model how these factors may affect the population of Unalaska.

As a rough approximation, the model also estimates Native population (assumed to be all resident) by assuming that Native population has grown at a constant growth rate of 2 percent since the 1980 census. Non-Native population is estimated by subtracting Native population from total resident population.

As another rough approximation, we assume that the school-age population is a constant share of the total resident population. We assume that this share remains constant at the estimated 1989 level of 15 percent.

### **Understanding the Details of the Model Structure**

For users who wish to thoroughly understand the details of the model structure, we recommend that they examine the model worksheet and trace the relationships between different cells. To simplify the process of tracing these relationships, cells which contain numbers which are directly assumed (for example, exogenous employment and most historical data) appear in bold upon the screen (they have been "unprotected"). Cells which contain formulas do not appear in bold (they are "protected").



### III. UNALASKA DESCRIPTION AND MODEL ASSUMPTIONS

#### History

Unalaska is located in the Aleutian Islands about 800 air miles southwest of Anchorage. The name Dutch Harbor, while actually referring to a body of water, has become a pseudonym for the part of the community located on Amaknak Island. Unalaska is a thriving port, strategically situated in a protected harbor. It is only 80 miles from Unimak Pass, the first navigable pass between the Alaska Peninsula and the Aleutian Islands. This pass is also used by ocean vessels traversing a great circle route from the Pacific coast of the Lower 48 states and Canada to the Orient.

Aleut Natives of the Aleutian islands depended on the sea for their food, clothing and other needs. In 1741, Russian explorers reached the Aleutian Islands and found an abundance of fur seals and sea otters. After years of exploiting these resources using forced Aleut labor, the Russians moved eastward in the late 1700s, leaving the Native population greatly reduced in number after exposure to new diseases. However, the Russians retained several strategic outposts until about 1850, including Iliuliuk Harbor, the site of Unalaska.

After the United States purchased Alaska in 1867, the Aleutians attracted fur traders again, as well as fishermen and whalers. Unalaska became a company town for the Alaska Commercial Company which took over the Russian-American Company facilities. Unalaska became an important coaling station and commercial trade center in the 1880s. During the Alaska gold rush period, many ships stopped at Dutch Harbor on their way through Unimak Pass. Unalaska was also a support center for Pribilof Island fur seal operations. By the early 1900s, Unalaska had several seafood processing plants which handled herring, salmon and whale meat. As oil replaced coal as a fuel for ships, Unalaska's coal trade diminished. Fox farming then sustained the area until the depression of the 1930s.

During World War II, Unalaska became a strategic port in the defense of the North Pacific. Dutch Harbor Naval Station and Fort Mears army base were established at Unalaska at the beginning of the war. In 1942, many Native residents were moved from Unalaska to Burnett Inlet north of Ketchikan where they remained until the end of the war. On June 3, 1942, carrier-based Japanese aircraft bombed Dutch Harbor. As a result, the military intensified their fortification efforts and engaged in major heavy construction. Tens of thousands of military personnel were stationed in the area. However, the military posts were abandoned in 1947, and by 1950 the population of Unalaska was only 173.

In the 1950s, there was renewed interest in harvesting the seas--this time for halibut, salmon and King crab. Unalaska began a period of continued growth in the commercial fishing and fish processing industries. The number of operating fish processing plants increased from one in 1962 to five in 1967 and fifteen in 1980.

The growth of Unalaska as a seafood processing center was largely due to the development of the Aleutian/Bering Sea King crab and Tanner crab fisheries. With the abrupt decline in King crab stocks between 1980 and 1983, fish processing activity in Unalaska dropped sharply.

Over the past few years, a new fish processing boom has occurred in Unalaska, as a result of the growth in groundfish processing. With the "Americanization" of groundfish fishing within the 200 mile zone, there was a rapid reallocation of groundfish processing from foreign floating processors to onshore processors. Production of surimi has been of growing importance and has contributed to a shift from seasonal to year-round economic activity.

Commercial fishing, fish processing and fisheries-related port services are the driving factors in the Unalaska economy. In 1989 Unalaska was the top port in the nation in volume of product landed (504 million pounds) and second in the nation in the dollar value of product landed (\$107.2). In addition, Unalaska serves as the primary support community

for the Bering Sea fishing industry, which employs some 30,000 persons in foreign and domestic fishing ventures (City of Unalaska, page 1).

The dramatic shifts in the Unalaska-based fishing industry over the past decade are illustrated by the changes in the volume and value of fish landed at Unalaska, shown in Table III.1. Between 1980 and 1984 the total volume of harvests fell from 136.5 to 46.9

**Table III.1:  
Volume and Value of Fish  
Landed at Unalaska, 1977-1989**

	VOLUME (millions of pounds)	VALUE (millions of dollars)	AVERAGE VALUE (\$/lb)
1977	100.5	61.4	0.61
1978	125.8	99.7	0.79
1979	136.8	92.7	0.68
1980	136.5	91.3	0.67
1981	73.0	57.6	0.79
1982	47.0	47.6	1.01
1983	48.9	36.4	0.74
1984	46.9	20.3	0.43
1985	106.3	21.3	0.20
1986	88.3	37.1	0.42
1987	128.2	62.7	0.49
1988	377.3	100.9	0.27
1989	504.3	107.4	0.21

Source: 1977-1986: National Marine Fisheries Service data cited in Department of Community and Regional Affairs community profile for Unalaska/Dutch Harbor. 1987-1989: National Marine Fisheries Service, Fisheries of the United States, May 1988 and May 1989.

million pounds. Harvests then rose to more than 500 million pounds by 1989. Harvest fluctuations were somewhat offset by higher prices in the early 1980s. In the second half of the decade, however, the average value of fish landed at Unalaska has been sharply lower, reflecting the greater proportion of lower-valued bottomfish in the harvest.

## Historical Employment Assumptions

### Alaska Department of Labor (ADOL) Employment Data

The primary source of employment data for Unalaska was unpublished Alaska Department of Labor (ADOL) quarterly employment data, by sector, for the Unalaska census subarea (subarea 563 before 1988 and 581 after 1988). These data were provided by ADOL to the Minerals Management Service. To calculate annual average employment, we averaged employment over the four quarters. The resulting annual employment data are shown in Table III.2.

**Adjustment for Akutan Employment.** For the years 1980-1987, the Unalaska census subarea included Akutan as well as several other smaller communities. Beginning in 1988, Akutan was included in the Unimak Island census subarea to recognize its presence in the Aleutians East Borough. As a result, the employment figures in Table III.2 for 1988 and 1989 are not directly comparable to the figures for 1980 through 1987.

In order to estimate Unalaska employment, we prepared rough estimates of employment in Akutan during the years 1980-1987, which are shown in Table III.3. We then subtracted the estimated Akutan employment from Table III.2 to derive adjusted estimates of employment for Unalaska, shown in Table III.4.

**Adjustments for Industries in Which Data Were Suppressed.** In the ADOL data, in order to guarantee confidentiality, for some quarters employment data were not available for some industries, including mining; wholesale trade; finance, insurance and real estate; and "miscellaneous." In Table II.2, average employment data were shown only for industries for which at least two quarters of employment data were available. We made a number of assumptions, described in the notes to Table III.4, to estimate employment in industries for which data were suppressed.

**Table III-2: Alaska Department of Labor Employment Estimates for Unalaska Census Subarea  
(annual average employment)**

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Mining										
Construction	5	12	21	16	23	13	14	9	15	13
Manufacturing	1056	1241	893	842	616	644	731	925	931	1105
Trans., Comm., Util.	37	67	86	100	72	70	75	85	115	179
Wholesale trade										
Retail trade	63	73	68	61	55	60	66	88	105	118
Finance, insurance and real estate	30	39	46	28	31	29	31	25		
Services	19	19	9	7	8	11	8	15	11	20
Miscellaneous								16		
Federal government	21	21	18	16	14	16	15	11	8	6
State government	2	5	7	11	14	11	7	4	6	6
Local government	85	109	119	127	110	116	111	112	102	113
<b>TOTAL</b>	<b>1317</b>	<b>1595</b>	<b>1274</b>	<b>1221</b>	<b>969</b>	<b>995</b>	<b>1072</b>	<b>1293</b>	<b>1347</b>	<b>1631</b>
Suppressed employment		9	8	14	27	26	16	4	54	72

Notes: Figures are averages of quarterly figures. For some industries and sectors, data were suppressed in order to preserve confidentiality. A blank indicates that data were suppressed for more than two quarters due to confidentiality reasons. Averages shown in the table are averages only for those quarters for which data were available. Averages were only provided if data were available for at least two quarters. Note that since employment was probably lower in quarters for which data were suppressed, averaging the data for the remaining quarters may overstate actual average employment. Total figures are average quarterly totals provided by the Department of Labor. Totals include suppressed employment except for 1980, for which the total is for non-suppressed employment. Source: Alaska Department of Labor, special computer runs for Unalaska census subarea provided to MMS.

**Table III.3: Assumed Akutan Employment, 1980-1987**

	1980	1981	1982	1983	1984	1985	1986	1987
Manufacturing	100	100	100	100	100	129	130	140
Trans., Comm. and Util.	3	3	3	3	3	3	3	3
Retail trade	1	1	1	1	1	1	1	1
Fin., Ins., Real Estate	1	2	3	4	5	5	5	5
Services	3	3	3	3	3	3	3	3
Federal government	1	1	1	1	1	1	1	1
Local government	3	5	7	8	9	10	10	10
<b>TOTAL</b>	<b>112</b>	<b>115</b>	<b>118</b>	<b>120</b>	<b>122</b>	<b>152</b>	<b>153</b>	<b>163</b>

Notes: Based on information provided in Northern Economics, Commercial Fishing Industry of the Bering Sea (Technical Report No. 138). Manufacturing employment figures for 1980-1985 are based on non-resident population estimates (page 105) and "current" Trident employment of 160 (page 106). Other employment is based on estimates of non-fishing employment in 1978 and 1985 (page 109).

**Table III-4: Adjusted Employment Estimates for Unalaska  
(annual average employment)**

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Fish harvesting	50	50	50	50	50	50	50	50	50	50
Mining	0	0	0	0	0	0	0	0	0	0
Construction	5	12	21	16	23	13	14	9	15	13
Manufacturing	956	1141	793	742	516	515	601	785	931	1105
Trans., Comm., Util.	34	64	83	97	69	67	72	82	115	179
Wholesale trade	2	2	3	5	5	3	1	4	6	9
Retail trade	62	72	67	60	54	59	65	87	105	118
Finance, insurance and real estate	28	36	42	23	26	24	26	25	25	25
Services	16	16	6	4	5	8	5	12	11	20
Miscellaneous	7	7	11	22	21	13	3	16	23	38
Federal government	20	20	17	15	13	15	14	10	8	6
State government	2	5	7	11	14	11	7	4	6	6
Local government	82	104	112	119	101	106	101	102	102	113
<b>TOTAL</b>	<b>1263</b>	<b>1528</b>	<b>1210</b>	<b>1163</b>	<b>896</b>	<b>883</b>	<b>956</b>	<b>1185</b>	<b>1397</b>	<b>1681</b>

Notes: Based on Table III.1 and III.2. To derive adjusted employment estimates, estimated Akutan employment was first subtracted from estimates for Unalaska census area for the years 1980-1987. Unalaska mining employment was assumed to be zero throughout the period. 1988 and 1989 employment in finance, insurance and real estate was assumed to be 25, or the same as the 1987 level. Wholesale trade was assumed to be 4 in 1987, the level of suppressed employment for that year if mining employment is assumed to be zero. 20% of suppressed employment for 1980-86 was assumed to be wholesale trade with the remainder miscellaneous. A similar adjustment was made for 1988 and 1987 after allowing for the assumed employment of 25 in finance, insurance and real estate.

**Other Limitations.** There are several other limitations to the ADOL employment data. The data do not include self-employed persons, which includes fishermen. As discussed below, we assumed annual resident fish harvesting employment of 50. In addition, the data do not necessarily count employees at their place of work. Thus employees of firms headquartered elsewhere who actually work in Unalaska may not be included in the estimates. In particular, construction activity may not be reflected in employment estimates. We assumed that all employment not shown for this reason may be considered "non-resident."

### Employment Origin and Residency Assumptions

After deriving the employment assumptions in Table III.4, we made assumptions about the origin and residency of employment for each industry, shown in Table III.5. We

Table III.5: Summary of Residency and Origin Assumptions, by Industry (Percent)

Industry	Resident	Enclave	Exogenous	Endogenous
Mining	100		100	
Construction	100			100
Manufacturing	5	95	100	
Trans., Comm., Util.	100		20	80
Wholesale trade	100			100
Retail trade	100		10	90
Finance, insurance and real estate	100			100
Services	100		20	80
Miscellaneous	100			100
Federal government	100		100	
State government	100		100	
Local government	100			100

assumed that all historical employment was resident except in manufacturing, where 95 percent of historical employment was enclave. Below we discuss our assumptions about the origin of employment in each industry.

**Fish Harvesting.** Although thousands of fishermen are employed in harvesting fish landed in Unalaska, and hundreds may be in the city at any given time, only a relative few are actually residents of Unalaska or spend very long in the community. Technical Report 138 provides a detailed discussion of resident fish harvesting employment (pages 249-257). According to this report, between 1981 and 1988, the number of commercial fishing permit holders resident in Unalaska varied between 73 and 57. The report also included estimates for these years of harvest sector resident employment, by species, based on applying assumed crew factors. The most important fisheries for local residents included King crab (employment ranging from a high of 94 to a low of 45), Tanner crab (a high of 83 to a low of 33) and halibut (a high of 99 to a low of 47). Different fisheries peaked in different years. However, these resident harvesting employment data are not on an annual average basis. In the absence of more detailed information, we assumed resident fish harvesting employment of 50 over the past decade. All of this employment was assumed to be exogenous.

**Mining.** The ADOL employment figures show mining employment of 0 prior to 1987. For 1988 and 1989, mining employment is undisclosed. Historical OCS exploration

support activity in Unalaska during the mid 1980s does not appear as mining employment in the ADOL data, although it is presumably included as services and transportation employment. We assumed mining employment of 0 for the years 1980-1989, although there may have been a small amount of mining activity based out of Unalaska in some years. All mining employment is assumed to be exogenous.

**Construction.** The construction employment figures provided by ADOL are significantly lower than the actual average number of persons working in construction in Unalaska. For example, ADOL's figure for construction employment for 1989 was only 13, even though tens of millions of dollars worth of construction projects were underway. It is likely that almost all construction in Unalaska is undertaken by firms based in other cities, with employment therefore being reported in other locations. Most construction workers in Unalaska are neither residents nor enclave workers. We assumed that all construction employment reported by ADOL was resident and that this employment is best characterized as endogenous.

**Manufacturing.** Manufacturing in Unalaska is overwhelmingly fish processing. Five onshore processors currently process about 200 million pounds of seafood annually. Manufacturing employment declined from 1141 in 1981 to 515 in 1985, and subsequently rose to 1105 in 1989. All manufacturing employment was assumed to be exogenous. We assumed that 95 percent of manufacturing employment was enclave, and only 5 percent was resident.

**Federal and State Government.** We assumed that all federal and state government employment was resident and exogenous. In other words, we assume that federal and state government employment does not vary directly with other employment.

**Transportation, Communication and Utilities; Retail Trade; Services.** For each of these three support industries, we assumed that employment was partly exogenous and partly endogenous. The exogenous share of employment serves the broader Bering Sea fishing industry. It may be thought of as that portion of these industries which would



remain even if there were no fish processing activity in Unalaska. Our assumed exogenous shares are based on very little data. It is clearly unrealistic, for example, to assume that these shares remained constant from 1980 through 1989. However, no data were available with which to estimate precisely the exogenous shares of these industries.

**Wholesale Trade; Finance, Insurance and Real Estate; Miscellaneous; and Local Government.** We assumed that all employment in these industries is endogenous.

### **Future Exogenous Employment Assumptions**

Users of the model may choose whatever exogenous employment assumptions they wish in order to explore different possible future scenarios for Unalaska. To illustrate how the model may be used, in Chapter IV of this report, we provide projections for three different scenarios or cases: a "low case," a "medium case," and a "high case." None of these cases is intended as a *prediction* of the future of Unalaska. Instead, they represent three different alternative futures for the community. Which of these cases will most closely resemble the future will depend upon the extent to which the assumptions in each case are actually borne out. Model users may wish to explore the effects of alternative assumptions.

**Fish harvesting.** For all cases, we assumed that fish harvesting employment will continue at 50 over the projection period.

**Onshore mining employment.** Although there is some geothermal potential, it is unlikely that onshore mining will become a significant employer. Thus, for all cases, we assume that onshore mining employment will be zero for the entire historical and projection period.

**OCS Mining Employment.** In order to provide for the primary objective of this model--evaluating the impacts of OCS exploration and/or development--the model provides for inclusion of detailed assumptions about OCS employment, in eight different categories:

- Onshore short-term skilled
- Onshore short-term non-skilled
- Onshore long-term skilled
- Onshore long-term non-skilled
- Offshore short-term skilled
- Offshore short-term non-skilled
- Offshore long-term skilled
- Offshore long-term non-skilled

In addition, the model provides for assumptions about the resident and enclave (as opposed to non-resident) shares of employment in each of these categories.

For all of our cases, we assume employment in each OCS category to be zero. For impact cases which explicitly include OCS employment, model users should note that all employment directly related to OCS activity should be included in these OCS employment categories, regardless of whether it is technically considered "mining."

### **Manufacturing**

Two new processing plants, scheduled to open in late 1990, will increase the annual processing capacity to 600 million pounds (Professional Growth Systems, page 7). Technical Report 138 provides a detailed review of the fish processing industry and several expansion projects currently underway (pages 259-268).

Unisea is constructing a factory to process surimi, salmon, halibut and fish meal, a cold storage and ice delivery system, a crab processing plant and living quarters. Existing operations will be moved into this facility. It is expected to create 300 new jobs when it opens in late 1990.

Westward Seafoods is constructing a twelve-building, 78 acre seafood processing plant on Captains Bay. The new facility, which is scheduled to open in 1991, will have the

capacity to process approximately 500-600 tons of pollock daily, supplied by up to 6 trawlers. It is expected to employ 500 new workers.

Unalaska city officials consider it unlikely that further fish processing expansion will occur in Unalaska beyond those projects which are already underway, which will substantially expand existing capacity. Both biological and political factors will affect the ability of Unalaska to sustain fish processing at the this substantially expanded capacity. First, harvests will depend upon natural factors: changes in resource stocks of both target and bycatch species. As groundfish harvests over the past few years have been at record levels, it is unlikely that they would rise significantly in the future. The crab crash of the early 1980s provides dramatic evidence of how rapidly seafood harvests can change.

Secondly, and perhaps equally importantly, processing activity will depend upon political factors: the allocation of harvests between vessels delivering to Unalaska processing plants and those delivering to offshore processors or onshore processors in other communities. With the rapid growth in the factory trawler fleet and the establishment of alternative onshore processors in communities such as St. Paul, vessels delivering to Unalaska will face increasing competition for limited harvests. The allocation of bycatch species such as halibut may play a major, indirect role in allocation of groundfish harvests. These allocation issues are already the subject of intense controversy, and the long-run outcome of allocation issues remains uncertain.

Given this uncertainty about the future of the fish processing industry, we made the following assumptions about manufacturing employment:

Medium and high cases:

Manufacturing employment expands from 1105 in 1989 to 1300 in 1990, 1500 in 1991, and 1700 in 1992, after which it remains constant. The share of resident employment in manufacturing employment remains constant at 5 percent.

Low case: Manufacturing employment expands from 1105 in 1989 to 1300 in 1990, 1500 in 1991, and 1700 in 1992. Subsequently, due to either natural or political factors, manufacturing employment declines to 1500 in 1993, 1300 in 1994, 1100 in 1995, and 900 in 1996, after which it remains constant at 900. The enclave share remains constant at 5 percent throughout.

### **Federal Government**

Medium and low cases:

Federal government employment remains constant at 6.

High case: Federal government employment increases by 50 in 1992 due to the establishment of a Coast Guard Marine Safety Office at Unalaska.

### **State Government**

In all cases, employment is assumed to remain constant at the 1989 level of 6.

### **Transportation, Communications and Utilities**

As noted above, we assumed an exogenous employment share of 20 percent in this industry because it includes transportation services for the offshore processing fleet as well as transshipment services for general cargo.

The city is tripling the size of its dock facility. The expanded dock will have a large crane capable of handling containerized cargo. It is expected that an increasing share of Bristol Bay and other Western Alaska fisheries products will be shipped through Dutch Harbor. Products would be barged from the fishing grounds to Dutch Harbor to be loaded onto large container ships, as is now being done in Kodiak for its fishery.

Community leaders have suggested that Unalaska could become a transshipment center for goods being transported from the North Pacific to Europe via the Soviet Union's northern Sea Route. Regular container ships would be used to transport goods from Pacific Rim ports to Unalaska. There, goods would be transferred to Soviet ice breaking ships and transported to Europe, significantly reducing total shipping time. Under a newly-announced maritime treaty with the Soviet Union, Russian ships may now pick up cargo in Unalaska for shipment to a third country and may enter Unalaska without the current two week advance notice. This is considered a first step in support of the transshipment scheme. (Professional Growth Consultants, page 9).

**Medium case:** In the medium case we assume that employment in transportation, communication and utilities will increase from 36 in 1989 to 43 in 1990, 50 in 1991, and 57 in 1992, after which it will remain constant.

**High case:** In the high case we assume that employment grows as in the medium case, but continues to grow by 7 jobs per year until 1997. Thus employment is 64 in 1993, 71 in 1994, 78 in 1995, 95 in 1996, and 102 in 1997.

**Low case:** Employment is assumed to increase from 36 in 1989 to 43 in 1990 and to remain constant after that.

### **Retail Trade**

As discussed above, we assumed a historical exogenous share of 10 percent for retail trade employment because it caters in part to the offshore trawler fleet. Alaska Commercial Company is planning a new "superstore, and another market is negotiating for land on which to build a supermarket (Professional Growth Consultants). In all cases, we assumed that the exogenous component of retail trade employment increases from 12 in 1989 to 14 in 1990, 17 in 1991 and 20 in 1992, as the retail trade sector expands to meet

existing exogenous demand. Subsequently we assume that exogenous employment remains constant at 1992 levels.

### **Services**

As discussed above, we assumed a historical exogenous share of 20 percent for services employment because it caters in part to the offshore trawler fleet. Expansion of service facilities is presently underway. Crowley Maritime is constructing a marine machine shop, and negotiations are underway for land to base a floating dry dock. Delta Western is constructing a large warehouse that will serve as a caselot food and general provisions outlet to service boats and the general public. (Professional Growth Consultants, page 9). For all cases, we assumed that exogenous services employment expands from 10 in 1989 to 12 in 1990, 14 in 1991, and 16 in 1992, and remains constant thereafter.

### **Summary of Exogenous Employment Assumptions in the Three Cases**

Table III.6 summarizes changes in assumed exogenous employment in the three cases. In the medium case, growth in Unalaska occurs over the next four years primarily as a result of increasing employment in manufacturing. After 1992, employment is stable.

In the low case, manufacturing employment rises sharply until 1992 and then falls rapidly until 1996 to below 1989 levels.

In the high case, exogenous employment growth is similar to the medium case, but growth is slightly higher and lasts longer due to continuing expansion in federal government and transportation, communication and utilities employment.

Table III.6: Summary of Changes in Assumed Exogenous Employment in the Medium, Low and High Cases

Industry	Year	Medium Case Employment	Low Case Employment	High Case Employment
<b>MANUFACTURING</b>				
	1989	1105	1105	1105
	1990	1300	1300	1300
	1991	1500	1500	1500
	1992	1700	1700	1700
	1993	1700	1500	1700
	1994	1700	1300	1700
	1995	1700	1100	1700
	1996	1700	900	1700
<b>FEDERAL GOVERNMENT</b>				
	1989	6	6	6
	1990	6	6	6
	1991	6	6	6
	1992	6	6	56
<b>TRANS., COMM. AND UTILITIES</b>				
	1989	36	36	36
	1990	43	43	43
	1991	50	43	50
	1992	57	43	57
	1993	57	43	64
	1994	57	43	71
	1995	57	43	78
	1996	57	43	85
	1997	57	43	92
<b>RETAIL TRADE</b>				
	1989	12	12	12
	1990	14	14	14
	1991	17	17	17
	1992	20	20	20
<b>SERVICES</b>				
	1989	10	10	10
	1990	12	12	12
	1991	14	14	14
	1992	16	16	16
<b>TOTAL OF ABOVE SECTORS</b>				
	1989	1169	1169	1169
	1990	1375	1375	1375
	1991	1587	1580	1587
	1992	1799	1785	1849
	1993	1799	1585	1856
	1994	1799	1385	1863
	1995	1799	1185	1870
	1996	1799	985	1877
	1997	1799	985	1884

Note: The table only shows exogenous employment in industries in which exogenous employment is assumed to change from 1989 levels. Exogenous employment is assumed to remain constant until 2010 at the last figure shown.

## Endogenous Employment Multiplier Assumptions

Our multiplier calculations, described in Chapter II, resulted in the estimated historical multipliers shown in Table III.7. The rapid increase in the estimated multipliers

**Table III.7: Calculation of Historical Employment Multipliers in the Unalaska Model**

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
<b>Estimated employment:</b>										
Exogenous resident	136	155	138	139	123	123	123	131	146	175
Exogenous enclave	908	1084	753	705	490	489	571	746	884	1050
Endogenous	220	290	321	320	284	272	265	310	366	457
<b>Assumed ratio of resident multiplier to enclave multiplier</b>										
	4	4	4	4	4	4	4	4	4	4
<b>Estimated multipliers:</b>										
Resident multiplier	0.61	0.68	0.98	1.01	1.16	1.11	1.00	0.98	1.00	1.05
Enclave multiplier	0.15	0.17	0.25	0.25	0.29	0.28	0.25	0.24	0.25	0.26
<b>Estimated shares of endogenous employment generated by:</b>										
Resident exogenous employment	82	106	136	141	142	136	123	128	146	183
Enclave employment	137	184	185	179	142	136	142	182	220	275

between 1980 and 1984, at a time when employment was falling rapidly, suggests that we may have either underestimated the multiplier in these earlier years (by underestimating endogenous employment) or overestimated it for subsequent years (by overestimating endogenous employment). Alternatively, there may have been a significant increase in the multiplier due to a process of import substitution. For example, local government employment grew rapidly between 1980 and 1983.

Without better data, it is not possible to estimate a more reliable historical multiplier. In any case, in more recent years the estimated multipliers have been much more stable.

In all cases, we assume that these multipliers remain at their estimated 1989 levels, with a resident exogenous employment multiplier of 1.05 and an enclave exogenous employment multiplier of 0.26.



## Population Assumptions

A major problem in discussing the population of Unalaska is the lack of reliable data. Population figures have been arrived at through a variety of methods which are not directly comparable. Available population data for Unalaska are summarized in Table III.8. This table also shows our assumed historical population assumptions and calculations. Our population categories in the model, "resident" and "enclave," correspond to the employment "residency" categories described in Chapter II.

Our historical population assumptions were derived as follows. For all years, we assumed that enclave population was 5 percent of total manufacturing employment. For 1980, we assumed that resident population was equal to 724, or the census figure of 1322 minus the 598 persons reported to have been "living in group quarters." For the years 1981-1986 and 1988-1989, we assumed that total (e.g. resident and enclave) population was equal to the published Department of Labor and/or Department of Community and Regional Affairs estimates for those years. For 1990 we assumed that total population was equal to the preliminary 1990 census population figure. We then estimated resident population as total population minus enclave population. The resulting estimated historical ratios of resident population to resident employment are shown in Table III.8. We assumed the estimated 1986 ratio of 2.02 to estimate a resident population figure for 1987.

In all cases, we assume that the ratio of future resident population to resident employment remains constant at the estimated 1990 level of 2.30. We recognize that this estimated ratio implies a fairly low labor force participation rate and a fairly high resident population multiplier. It is possible that this multiplier is an overestimate, which could result from inconsistent population and employment data for 1990.

Our high resident population multiplier means that a fairly higher resident population impact will be projected for new resident jobs. Model users who feel that the this multiplier is too high may wish to assume a lower population multiplier, such as 2.0 or 1.5.

**Table III.8: Unalaska Population Data, Assumptions and Calculations**

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
<b>UNALASKA POPULATION DATA</b>											
U.S. Census (a)	1322										2899
Alaska Department of Labor (b)		1944	1992	1677	1447	1331	1354				
Alaska Department of Community and Regional Affairs									1908	2265	
<b>OTHER POPULATION DATA</b>											
Unalaska School enrollment (c)	162	195	190	175	152	135	138	145	151	187	
Alaska Permanent Fund dividend applications (d)											
Ages 0-17			221	0	0	0					
Ages 0-4			0	62	54	66					
Ages 5-17			0	126	107	128					
Ages 18-27			347	232	225	205					
Ages 28-37			378	288	279	291					
Ages 38-47			132	111	119	149					
Ages 48-57			90	61	56	55					
Ages 58-67			35	28	27	31					
Ages 68-77			6	5	7	9					
Ages 78+			2	2	2	2					
Unknown			0	3	1	3					
Total			1211	918	877	939	1041				
<b>HISTORICAL POPULATION ASSUMPTIONS AND CALCULATIONS</b>											
Total pop., enclave plus resident	1632	1944	1992	1677	1447	1331	1354	1634	1908	2265	2899
- Enclave population	908	1084	753	705	490	489	571	746	884	1050	1235
= Resident population	724	860	1239	972	957	842	783	888	1024	1215	1664
Resident employment	356	445	459	459	407	395	388	440	513	632	724
Ratio of resident population to resident employment	2.03	1.93	2.70	2.12	2.35	2.13	2.02	2.02	2.00	1.92	2.30
Resident population: total	724	860	1239	972	957	842	783	888	1024	1215	1664
School-age (5-18)	162	195	190	175	152	135	138	145	151	187	256
Ratio of school-age to total	0.22	0.23	0.15	0.18	0.16	0.16	0.18	0.16	0.15	0.15	0.15
Native pop. growth rate	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020
Native population: total	200	204	208	212	216	221	225	230	234	239	244
Non-Native population: total	524	656	1031	760	740	621	558	659	789	976	1420

(a) For 1980 figure, see SESP Technical Report 87, page II-9. Figure includes 598 persons living in group quarters. 1990 figure is a preliminary figure reported in the Anchorage Daily News, September 5, 1990.

(b) Figures published in Alaska Population Overview, 1981, p. 3; 1982, p. 7; Sept. 1985, p. 76; 1985, p. 54.; 1986, p. 117.

(c) See SESP Technical Report 128, page 108 for 1980-1987 figures. 1988 and 1989 figures were provided by John Novak, Unalaska School Superintendent, personal communication, August 1990.

(d) Figures published in Alaska Department of Revenue, Permanent Fund Dividend Recipient Profiles, 1982-1985.

(e) DCRA figures cited in Professional Growth Systems, Health Care Facility Feasibility Study, page 10.

#### IV. UNALASKA MODEL PROJECTIONS

This chapter presents three different sets of Unalaska model projections, resulting from our medium, high and low case assumptions described in the previous chapter. As stated earlier, these projections are not intended as predictions of the future, but rather as illustrations of what the future might look like under three different scenarios. All of the scenarios are simplistic, in that the only change from the present is that exogenous employment changes for a few years, and then stabilizes.

This simplicity is appropriate for the primary intended use of the model, which is to examine the *impacts* of specific projects upon the community of Unalaska, in particular OCS development. Although constant projections for future population and employment are clearly unrealistic, they can provide a useful "base case" against which to measure the employment and population impacts of a project of a given scale.

The tables and graphs presented in this chapter also illustrate the tables and graphs generated by macros within the model.

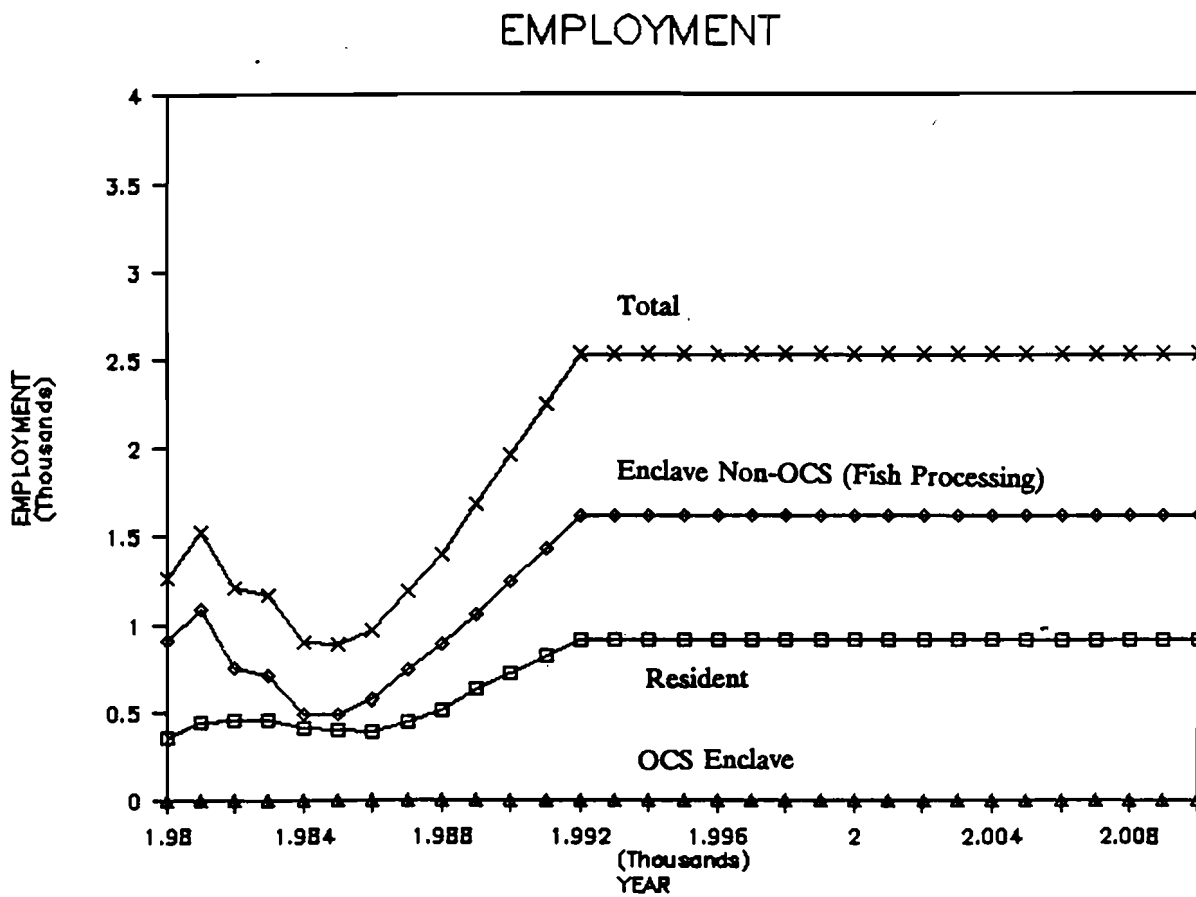
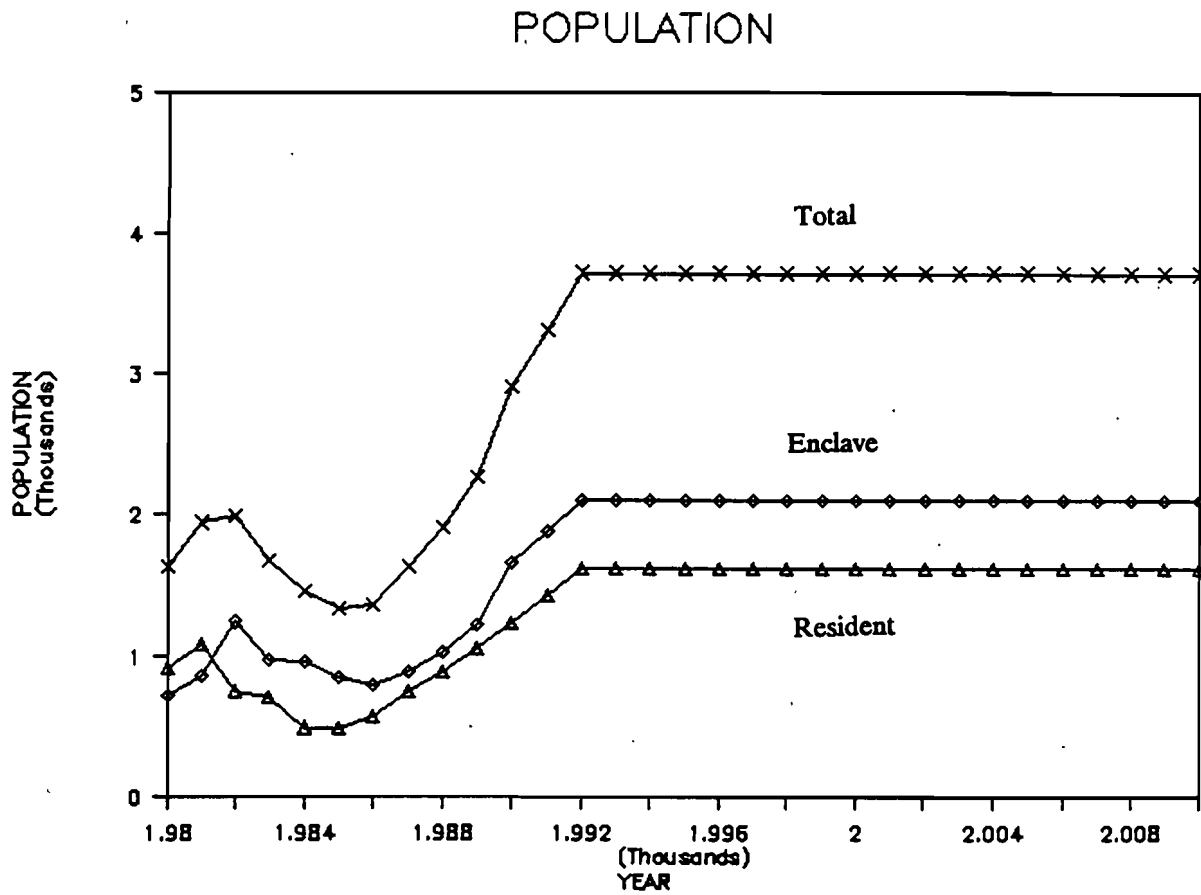
##### Medium Case Projections

Medium case projections are summarized in Table IV.1 and Figure IV.1. In the medium case rising manufacturing employment causes employment and population to rise rapidly until 1992. After 1992, total employment stabilizes at 2528 and total population stabilizes at 3714. Resident employment stabilizes at 913 and resident population stabilizes at 2099.

Table IV.1: Summary of Employment and Population Projections for Medium Case

YEAR	EMPLOYMENT				POPULATION							
	Resident Non-OCS	Resident OCS	Resident Total	Enclave Fish-Process.	Enclave OCS	Enclave Total	Total, Resident and Enclave	Resident	Resident Native	Non-Native	Enclave	Total
1980	356	0	356	908	0	908	1264	724	200	524	908	1632
1981	445	0	445	1084	0	1084	1529	860	204	656	1084	1944
1982	459	0	459	753	0	753	1212	1239	208	1031	753	1992
1983	459	0	459	705	0	705	1164	972	212	760	705	1677
1984	407	0	407	490	0	490	897	957	216	740	490	1447
1985	395	0	395	489	0	489	884	842	221	621	489	1331
1986	388	0	388	571	0	571	959	783	225	558	571	1354
1987	440	0	440	746	0	746	1186	888	230	659	746	1634
1988	513	0	513	884	0	884	1397	1024	234	789	884	1908
1989	632	0	632	1050	0	1050	1682	1215	239	976	1050	2265
1990	724	0	724	1235	0	1235	1959	1664	244	1420	1235	2899
1991	819	0	819	1425	0	1425	2244	1882	249	1633	1425	3307
1992	913	0	913	1615	0	1615	2528	2099	254	1846	1615	3714
1993	913	0	913	1615	0	1615	2528	2099	259	1841	1615	3714
1994	913	0	913	1615	0	1615	2528	2099	264	1835	1615	3714
1995	913	0	913	1615	0	1615	2528	2099	269	1830	1615	3714
1996	913	0	913	1615	0	1615	2528	2099	275	1825	1615	3714
1997	913	0	913	1615	0	1615	2528	2099	280	1819	1615	3714
1998	913	0	913	1615	0	1615	2528	2099	286	1814	1615	3714
1999	913	0	913	1615	0	1615	2528	2099	291	1808	1615	3714
2000	913	0	913	1615	0	1615	2528	2099	297	1802	1615	3714
2001	913	0	913	1615	0	1615	2528	2099	303	1796	1615	3714
2002	913	0	913	1615	0	1615	2528	2099	309	1790	1615	3714
2003	913	0	913	1615	0	1615	2528	2099	315	1784	1615	3714
2004	913	0	913	1615	0	1615	2528	2099	322	1778	1615	3714
2005	913	0	913	1615	0	1615	2528	2099	328	1771	1615	3714
2006	913	0	913	1615	0	1615	2528	2099	335	1765	1615	3714
2007	913	0	913	1615	0	1615	2528	2099	341	1758	1615	3714
2008	913	0	913	1615	0	1615	2528	2099	348	1751	1615	3714
2009	913	0	913	1615	0	1615	2528	2099	355	1744	1615	3714
2010	913	0	913	1615	0	1615	2528	2099	362	1737	1615	3714

Figure IV.1: Medium Case Projections



### High Case Projections

High case projections are summarized in Tables IV.2 and IV.3 and in Figure IV.2. In the high case exogenous employment continues to rise for several years longer than in the medium case, due to continuing growth in federal government employment and transportation, communication and utilities employment. After 1997, total employment stabilizes at 2702 and total population stabilizes at 4114. Resident employment stabilizes at 1087 and resident population stabilizes at 2499. Thus the long-term "impact" of the assumed higher exogenous employment is an increase in total employment of 174 and an increase in total population of 400.

### Low Case Projections

Low case projections are summarized in Tables IV.4 and IV.5 and in Figure IV.3. In the low case exogenous employment first rises and then falls sharply for several years after 1993 due to an assumed decline in fish processing. After 1996, total employment stabilizes at 1389 and total population stabilizes at 2244. Resident employment stabilizes at 604 and resident population stabilizes at 1389. Thus the long-term "impact" of the assumed higher exogenous employment is a decrease in total employment of 1069 and a decrease in total population of 1471.

Table IV.2: Summary of Employment and Population Projections for High Case

YEAR	EMPLOYMENT				POPULATION							
	Resident Non-OCS	Resident OCS	Resident Total	Enclave Fish-Process.	Enclave OCS	Enclave Total	Total, Resident and Enclave	Resident Native	Resident Non-Native	Enclave	Total	
1980	356	0	356	908	0	908	1264	724	200	524	908	1632
1981	445	0	445	1084	0	1084	1529	860	204	656	1084	1944
1982	459	0	459	753	0	753	1212	1239	208	1031	753	1992
1983	459	0	459	705	0	705	1164	972	212	760	705	1677
1984	407	0	407	490	0	490	897	957	216	740	490	1447
1985	395	0	395	489	0	489	884	842	221	621	489	1331
1986	388	0	388	571	0	571	959	783	225	558	571	1354
1987	440	0	440	746	0	746	1186	888	230	659	746	1634
1988	513	0	513	884	0	884	1397	1024	234	789	884	1908
1989	632	0	632	1050	0	1050	1682	1215	239	976	1050	2265
1990	724	0	724	1235	0	1235	1959	1664	244	1420	1235	2899
1991	819	0	819	1425	0	1425	2244	1882	249	1633	1425	3307
1992	1016	0	1016	1615	0	1615	2631	2334	254	2081	1615	3949
1993	1030	0	1030	1615	0	1615	2645	2367	259	2109	1615	3982
1994	1044	0	1044	1615	0	1615	2659	2400	264	2136	1615	4015
1995	1059	0	1059	1615	0	1615	2674	2433	269	2164	1615	4048
1996	1073	0	1073	1615	0	1615	2688	2466	275	2192	1615	4081
1997	1087	0	1087	1615	0	1615	2702	2499	280	2219	1615	4114
1998	1087	0	1087	1615	0	1615	2702	2499	286	2213	1615	4114
1999	1087	0	1087	1615	0	1615	2702	2499	291	2208	1615	4114
2000	1087	0	1087	1615	0	1615	2702	2499	297	2202	1615	4114
2001	1087	0	1087	1615	0	1615	2702	2499	303	2196	1615	4114
2002	1087	0	1087	1615	0	1615	2702	2499	309	2190	1615	4114
2003	1087	0	1087	1615	0	1615	2702	2499	315	2184	1615	4114
2004	1087	0	1087	1615	0	1615	2702	2499	322	2177	1615	4114
2005	1087	0	1087	1615	0	1615	2702	2499	328	2171	1615	4114
2006	1087	0	1087	1615	0	1615	2702	2499	335	2164	1615	4114
2007	1087	0	1087	1615	0	1615	2702	2499	341	2158	1615	4114
2008	1087	0	1087	1615	0	1615	2702	2499	348	2151	1615	4114
2009	1087	0	1087	1615	0	1615	2702	2499	355	2144	1615	4114
2010	1087	0	1087	1615	0	1615	2702	2499	362	2137	1615	4114

Table IV.3: Comparison of High Case (Impact Case) and Medium Case (Base Case)

YEAR	RESIDENT EMPLOYMENT		ENCLAVE EMPLOYMENT			RESIDENT POPULATION			TOTAL POPULATION			
	Impact Case	Base Case	Impact	Impact Case	Base Case	Impact	Impact Case	Base Case	Impact	Impact Case	Base Case	Impact
1980	356	356	0	908	908	0	724	724	0	1632	1632	0
1981	445	445	0	1084	1084	0	860	860	0	1944	1944	0
1982	459	459	0	753	753	0	1239	1239	0	1992	1992	0
1983	459	459	0	705	705	0	972	972	0	1677	1677	0
1984	407	407	0	490	490	0	957	957	0	1447	1447	0
1985	395	395	0	489	489	0	842	842	0	1331	1331	0
1986	388	388	0	571	571	0	783	783	0	1354	1354	0
1987	440	440	0	746	746	0	888	888	0	1634	1634	0
1988	513	513	0	884	884	0	1024	1024	0	1908	1908	0
1989	632	632	0	1050	1050	0	1215	1215	0	2265	2265	0
1990	724	724	0	1235	1235	0	1664	1664	0	2899	2899	0
1991	819	819	0	1425	1425	0	1882	1882	0	3307	3307	0
1992	1016	913	102	1615	1615	0	2334	2099	235	3949	3714	235
1993	1030	913	117	1615	1615	0	2367	2099	268	3982	3714	268
1994	1044	913	131	1615	1615	0	2400	2099	301	4015	3714	301
1995	1059	913	145	1615	1615	0	2433	2099	334	4048	3714	334
1996	1073	913	160	1615	1615	0	2466	2099	367	4081	3714	367
1997	1087	913	174	1615	1615	0	2499	2099	400	4114	3714	400
1998	1087	913	174	1615	1615	0	2499	2099	400	4114	3714	400
1999	1087	913	174	1615	1615	0	2499	2099	400	4114	3714	400
2000	1087	913	174	1615	1615	0	2499	2099	400	4114	3714	400
2001	1087	913	174	1615	1615	0	2499	2099	400	4114	3714	400
2002	1087	913	174	1615	1615	0	2499	2099	400	4114	3714	400
2003	1087	913	174	1615	1615	0	2499	2099	400	4114	3714	400
2004	1087	913	174	1615	1615	0	2499	2099	400	4114	3714	400
2005	1087	913	174	1615	1615	0	2499	2099	400	4114	3714	400
2006	1087	913	174	1615	1615	0	2499	2099	400	4114	3714	400
2007	1087	913	174	1615	1615	0	2499	2099	400	4114	3714	400
2008	1087	913	174	1615	1615	0	2499	2099	400	4114	3714	400
2009	1087	913	174	1615	1615	0	2499	2099	400	4114	3714	400
2010	1087	913	174	1615	1615	0	2499	2099	400	4114	3714	400



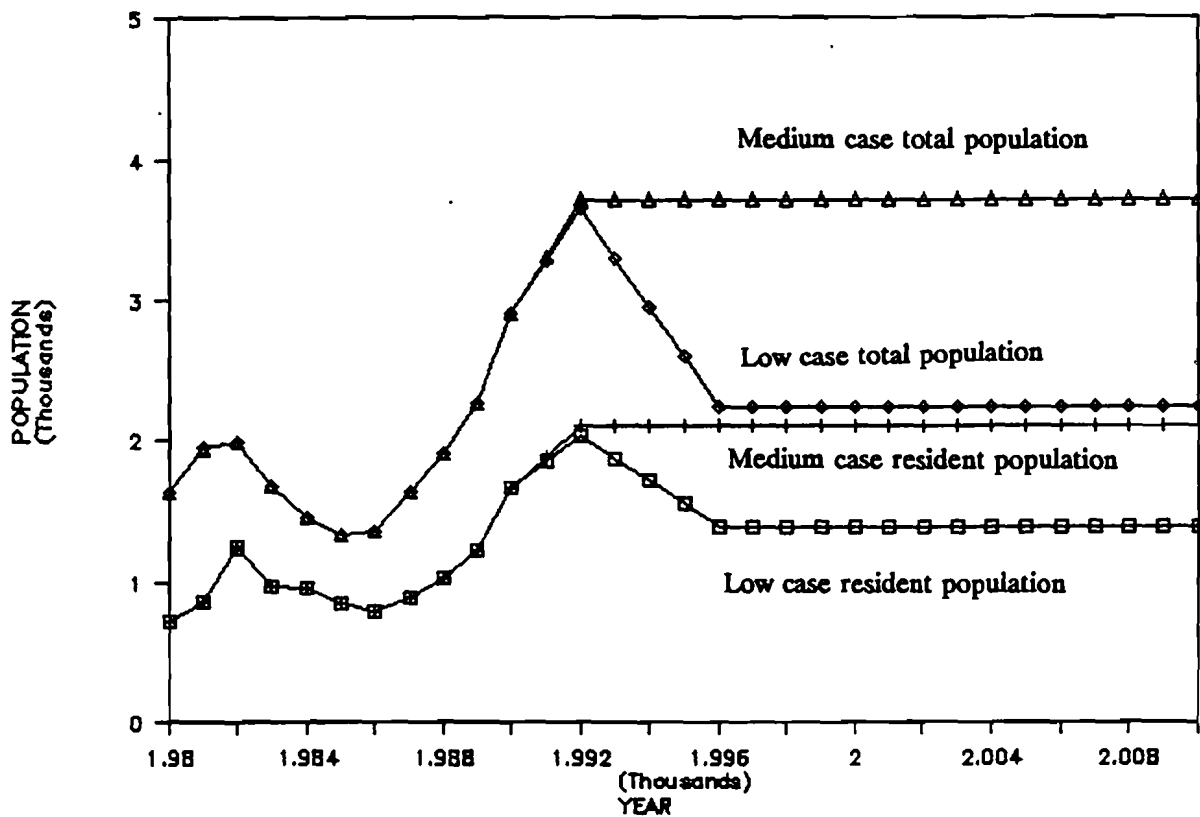
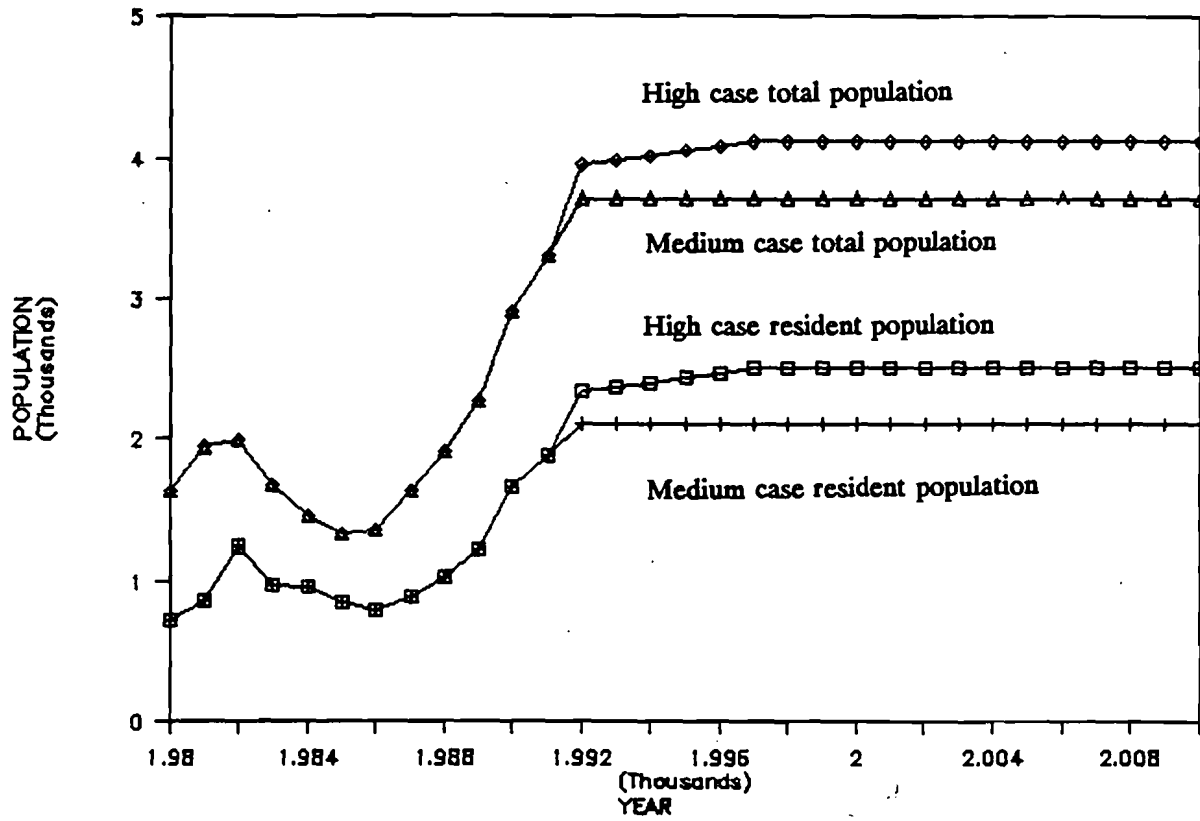
Table IV.4: Summary of Employment and Population Projections for Low Case

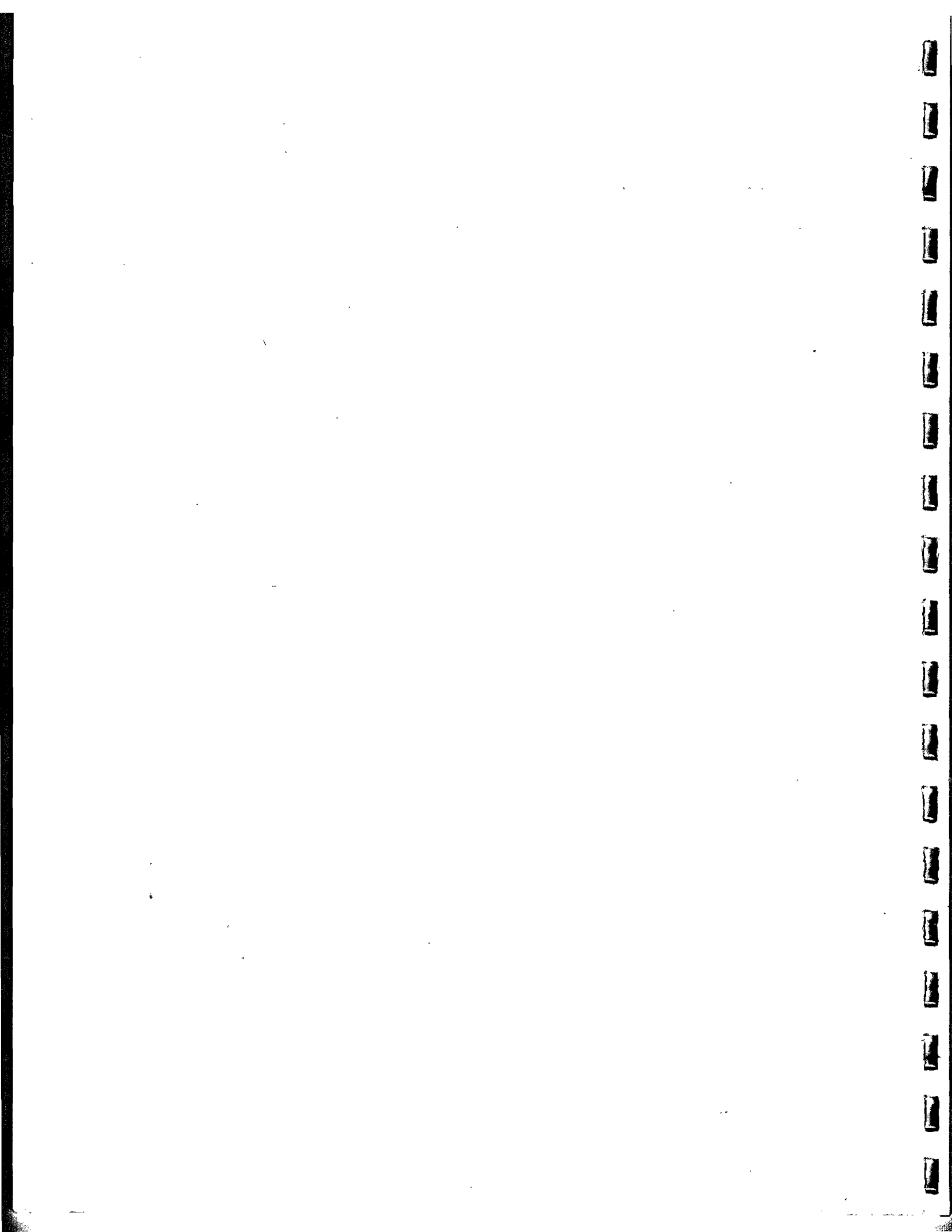
YEAR	EMPLOYMENT						POPULATION					
	Resident Non-OCS	Resident OCS	Resident Total	Enclave Fish- Process.	Enclave OCS	Enclave Total	Total, Resident and Enclave	Resident	Resident Native	Non- Native	Enclave	Total
1980	356	0	356	908	0	908	1264	724	200	524	908	1632
1981	445	0	445	1084	0	1084	1529	860	204	656	1084	1944
1982	459	0	459	753	0	753	1212	1239	208	1031	753	1992
1983	459	0	459	705	0	705	1164	972	212	760	705	1677
1984	407	0	407	490	0	490	897	957	216	740	490	1447
1985	395	0	395	489	0	489	884	842	221	621	489	1331
1986	388	0	388	571	0	571	959	783	225	558	571	1354
1987	440	0	440	746	0	746	1186	888	230	659	746	1634
1988	513	0	513	884	0	884	1397	1024	234	789	884	1908
1989	632	0	632	1050	0	1050	1682	1215	239	976	1050	2265
1990	724	0	724	1235	0	1235	1959	1664	244	1420	1235	2899
1991	804	0	804	1425	0	1425	2229	1849	249	1600	1425	3274
1992	885	0	885	1615	0	1615	2500	2033	254	1780	1615	3648
1993	815	0	815	1425	0	1425	2240	1872	259	1614	1425	3297
1994	744	0	744	1235	0	1235	1979	1711	264	1447	1235	2946
1995	674	0	674	1045	0	1045	1719	1550	269	1281	1045	2595
1996	604	0	604	855	0	855	1459	1389	275	1114	855	2244
1997	604	0	604	855	0	855	1459	1389	280	1109	855	2244
1998	604	0	604	855	0	855	1459	1389	286	1103	855	2244
1999	604	0	604	855	0	855	1459	1389	291	1097	855	2244
2000	604	0	604	855	0	855	1459	1389	297	1091	855	2244
2001	604	0	604	855	0	855	1459	1389	303	1085	855	2244
2002	604	0	604	855	0	855	1459	1389	309	1079	855	2244
2003	604	0	604	855	0	855	1459	1389	315	1073	855	2244
2004	604	0	604	855	0	855	1459	1389	322	1067	855	2244
2005	604	0	604	855	0	855	1459	1389	328	1060	855	2244
2006	604	0	604	855	0	855	1459	1389	335	1054	855	2244
2007	604	0	604	855	0	855	1459	1389	341	1047	855	2244
2008	604	0	604	855	0	855	1459	1389	348	1040	855	2244
2009	604	0	604	855	0	855	1459	1389	355	1033	855	2244
2010	604	0	604	855	0	855	1459	1389	362	1026	855	2244

Table IV.5: Comparison of Low Case (Impact Case) and Medium Case (Base Case)

YEAR	RESIDENT EMPLOYMENT		ENCLAVE EMPLOYMENT			RESIDENT POPULATION			TOTAL POPULATION			
	Impact Case	Base Case	Impact	Impact Case	Base Case	Impact	Impact Case	Base Case	Impact	Impact Case	Base Case	Impact
1980	356	356	0	908	908	0	724	724	0	1632	1632	0
1981	445	445	0	1084	1084	0	860	860	0	1944	1944	0
1982	459	459	0	753	753	0	1239	1239	0	1992	1992	0
1983	459	459	0	705	705	0	972	972	0	1677	1677	0
1984	407	407	0	490	490	0	957	957	0	1447	1447	0
1985	395	395	0	489	489	0	842	842	0	1331	1331	0
1986	388	388	0	571	571	0	783	783	0	1354	1354	0
1987	440	440	0	746	746	0	888	888	0	1634	1634	0
1988	513	513	0	884	884	0	1024	1024	0	1908	1908	0
1989	632	632	0	1050	1050	0	1215	1215	0	2265	2265	0
1990	724	724	0	1235	1235	0	1664	1664	0	2899	2899	0
1991	804	819	-14	1425	1425	0	1849	1882	-33	3274	3307	-33
1992	885	913	-29	1615	1615	0	2033	2099	-66	3648	3714	-66
1993	815	913	-99	1425	1615	-190	1872	2099	-227	3297	3714	-417
1994	744	913	-169	1235	1615	-380	1711	2099	-388	2946	3714	-768
1995	674	913	-239	1045	1615	-570	1550	2099	-550	2595	3714	-1120
1996	604	913	-309	855	1615	-760	1389	2099	-711	2244	3714	-1471
1997	604	913	-309	855	1615	-760	1389	2099	-711	2244	3714	-1471
1998	604	913	-309	855	1615	-760	1389	2099	-711	2244	3714	-1471
1999	604	913	-309	855	1615	-760	1389	2099	-711	2244	3714	-1471
2000	604	913	-309	855	1615	-760	1389	2099	-711	2244	3714	-1471
2001	604	913	-309	855	1615	-760	1389	2099	-711	2244	3714	-1471
2002	604	913	-309	855	1615	-760	1389	2099	-711	2244	3714	-1471
2003	604	913	-309	855	1615	-760	1389	2099	-711	2244	3714	-1471
2004	604	913	-309	855	1615	-760	1389	2099	-711	2244	3714	-1471
2005	604	913	-309	855	1615	-760	1389	2099	-711	2244	3714	-1471
2006	604	913	-309	855	1615	-760	1389	2099	-711	2244	3714	-1471
2007	604	913	-309	855	1615	-760	1389	2099	-711	2244	3714	-1471
2008	604	913	-309	855	1615	-760	1389	2099	-711	2244	3714	-1471
2009	604	913	-309	855	1615	-760	1389	2099	-711	2244	3714	-1471
2010	604	913	-309	855	1615	-760	1389	2099	-711	2244	3714	-1471

Figure IV.2:  
 Comparison of High Case and Low Case Population Projections  
 with Medium Case Population Projections





## V. COLD BAY MODEL, ASSUMPTIONS AND PROJECTIONS

This chapter presents an employment and population model for Cold Bay, Alaska. The model was developed for use by the Minerals Management Service (MMS) in projecting potential employment and population impacts of OCS exploration and development support activities in Cold Bay. The model is a Lotus 1-2-3 worksheet (COLDBAY.WK1).

The Cold Bay model is much simpler in structure than the Unalaska model, with only a few employment and population variables. Given the small size of the community, we did not feel that an elaborate model was justified. Multiplier relationships are small: new exogenous jobs in activities such as OCS would not have a large impact in creating other employment or bringing other people to the community.

### Data Sources

The data used in developing the model were derived from several earlier Technical Reports published by the MMS Social and Economic Studies Program. These included John Petterson et al., *Cold Bay: Ethnographic Study and Impact Analysis* (Technical Report No. 93, 1983), Gunnar Knapp et al., *St. George Basin and North Aleutian Basin Economic and Demographic Systems Impacts Analysis* (Technical Report No. 87, June 1984), and Stephen Braund et al., *A Description of the Socioeconomic and Sociocultural Systems of the Aleutian Pribilof Islands Region* (Technical Report No. 118, 1986).

### Population and Employment Data

The population and employment data upon which the model is based are shown in Table V.1. Data sources are discussed in the notes to the table. The most recent year for which employment data are available was 1986. We do not attempt to distinguish between resident and enclave employment.

Table V.1: Cold Bay Population and Employment Data and Assumptions

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
<b>POPULATION DATA AND ASSUMPTIONS</b>											
Census designated place (a,b)	228		250	237	246						
Incorporated city (c)	192				188	157	187		154		158
Assumed population	192		191	181	188	157	187		154		158
<b>EMPLOYMENT ASSUMPTIONS (d)</b>											
<b>Exogenous Employment</b>											
Basic			6				6				
Support			71				58				
Government			54				38				
<b>Endogenous Employment</b>											
Support			14				11				
Government			9				7				

- (a) Cold Bay was not incorporated until 1982. The 1980 census data and several years of Alaska Population Overview data are for this Census Designated Place rather than the smaller incorporated city.
- (b) Source is Alaska Department of Labor, Alaska Population Overview, various editions, as follows: 1980, 1983 and 1984: September 1985, page 52. August 1989, page 112; 1982: Alaska Population Overview, 1982 (published in 1983), page 7.
- (c) Source is Alaska Department of Labor, Alaska Population Overview, various editions, as follows: 1980: August 1989, page 112; 1984 and 1985: April 1987, page 54; 1986: August 1989, page 112. 1988: August 1989 ("Preliminary Household Data"), page 2. 1990 figure is preliminary census figure, as reported by Linda Cramer, Cold Bay city clerk, personal communication, September 6, 1990. She believes this figure to be an underestimate.
- (d) 1982 estimates are based on Technical Report 87, page E-6. 1986 estimates are based on data in Technical Report 122, Appendix B, page B-3. Basic employment includes manufacturing employment only. Endogenous government employment includes state magistrate, municipal clerk, and Rural Education Attendance Area employment (5). Endogenous support employment includes construction (2), Interior Telephone Company (1), Cold Bay Truck Rental (2), and 6 employees of Reeve Aleutian Airways.

## Model Structure and Assumptions

Table V.2 is a printout of the model for the years 1982 through 1995. Historical data are only shown for 1982 and 1986. Employment in 1990 is estimated based on population, and the first model projection year is 1991.

Figures shown in **bold** in the printout are assumptions which were entered directly in the model. Figures not shown in bold were calculated based on these assumptions.

For 1982 and 1986, employment and population data were assumed based on historical data. We used the historical employment data to calculate a historical "employment multiplier" (ratio of endogenous to exogenous employment). This multiplier was the same for both 1982 and 1986. In subsequent years, we assume that the endogenous employment multiplier remains the same. Endogenous employment is projected by multiplying this assumed employment multiplier by assumed exogenous employment.

We also calculated a historical population multiplier (ratio of population to employment). The 1982 multiplier (1.24) was considerably lower than the 1986 multiplier (1.56). We believe the 1982 multiplier to be based on a more reliable population figure which is more consistent with the observation of other MMS studies that most people in Cold Bay are employed. Thus we assume a population multiplier of 1.24 for future years.

The employment multiplier and the population multiplier in essence constitute the model. To project future employment, exogenous employment is assumed. Endogenous employment is then calculated using the employment multiplier, and population is calculated using the population multiplier. These relationships can be seen easily by inspecting the formulas in the worksheet.

## Future Exogenous Employment Assumptions

The Cold Bay economy is based upon the provision of transportation services. At present these are primarily related to air transportation. However, the city hopes to develop water transportation services. In particular, there is hope that with completion of a new dock Cold Bay will become a convenient port for fishing vessels to pick up new crew.

The projections shown in Table V.2 and V.3 are based upon the assumption that exogenous support employment (in transportation) will grow by 2 per year until 1996, after which it will remain constant. This would cause employment to grow from 127 to 140, and population to increase from 158 to 173.



Table V.2: Listing of the Cold Bay Model, 1982-1995

COLDBAY Economic and demographic projection model for Cold Bay, Alaska, developed for the Minerals Management Service for use in projecting the economic impacts of OCS development.

"Impact Case" is current case. "Base Case" is previous case.

MACROS:

- K: Recalculates the model and creates all tables.
- M: Views Graph 1: Summary of Impact Case Projections
- N: Views Graph 2: Comparison of Impact Case and Base Case Projections
- P: Prints Table 1: Impact Case Projections, as print file table1.prn
- Q: Prints Table 2: Base Case Projections, as print file table2.prn
- R: Prints Table 3: Summary of Impacts, as print file table3.prn
- S: Views Table 1: Impact Case Projections
- T: Views Table 2: Base Case Projections
- V: Views Table 3: Summary of Impacts

VARIABLE		1982	1986	1990	1991	1992	1993	1994	1995	
EMPLOYMENT	Total Employment	154	120	127	127	130	133	135	137	
	Exogenous: Total	131	102	108	108	111	113	115	117	
	OCS	0	0	0	0	0	0	0	0	
	Other Basic	6	6	6	6	6	6	6	6	
	Support	71	58	62	62	64	66	68	70	
	Government	54	38	40	40	40	40	40	40	
	Endogenous: Total	23	18	19	19	20	20	20	21	
	Support	14	11	12	12	12	12	12	13	
	Government	9	7	7	7	8	8	8	8	
	Non-OCS Employment	154	120	127	127	130	133	135	137	
	Ratio of Endogenous to Exogenous (employment multiplier)	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18
	Share of exogenous employment									
	OCS	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Other Basic	0.54	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
	Support	0.41	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57
Government	0.18	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	
Share of endogenous employment										
Support	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	
Government	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	
POPULATION	Total Population	191	187	158	158	162	164	167	170	
	Ratio of Population to Employment (Population Multiplier)	1.24	1.56	1.24	1.24	1.24	1.24	1.24	1.24	

Table V.3: Cold Bay Model Projections

Year	----- Employment -----			Popul- ation
	OCS	Non-OCS	Total	
1982	0	154	154	191
1986	0	120	120	187
1990	0	127	127	158
1991	0	127	127	158
1992	0	130	130	162
1993	0	133	133	164
1994	0	135	135	167
1995	0	137	137	170
1996	0	140	140	173
1997	0	140	140	173
1998	0	140	140	173
1999	0	140	140	173
2000	0	140	140	173
2001	0	140	140	173
2002	0	140	140	173
2003	0	140	140	173
2004	0	140	140	173
2005	0	140	140	173
2006	0	140	140	173
2007	0	140	140	173
2008	0	140	140	173
2009	0	140	140	173
2010	0	140	140	173

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## APPENDIX A: USING THE UNALASKA MODEL

The Unalaska model is stored on the disk in a file named UNALASKA.WK1. The model is invoked by a Lotus 1-2-3 "File Retrieve" command. In the worksheet, each column beginning with column C represents a year. Variable definitions are given in Column B. Variables which were entered directly into the model as assumptions have been "unprotected," so that they appear in bold on the computer screen. Variables which are calculated by the model are "protected" so that they do not appear in bold. Unless the user wishes to explicitly change the model structure, variables should never be entered directly in "protected" cells, because this will replace the formula entered in the cell.

The top left-hand corner of the worksheet provides a summary of macro commands which may be used to create or view summary tables and graphs. At any time, the worksheet represents one economic and demographic simulation for Unalaska. In order to examine the impact of a change in an assumption, type in the new assumptions (these should be entered only in cells which appear in bold). Then hit macro "K." This saves a summary of the projections with the initial assumptions in Table 2, recalculates the model for the new assumptions, and saves a summary of the new projections in Table 1. Table 3 and Graphs 3 and 4 may be used to compare the changes in key model variables as a result of changes in assumptions.

It is useful when working with the model to use the "WORKSHEET TITLES BOTH" command so that the years and variables names are visible wherever one is in the worksheet.

## APPENDIX B: LISTING OF THE UNALASKA MODEL, 1980-2000

**UNALASKA** Economic and demographic projection model for Unalaska, Alaska, developed for the Minerals Management Service for use in projecting the economic impacts of OCS development.

"Impact Case" is current case. "Base Case" is previous case.

**MACROS:**

- K: Recalculates the model and creates all tables.
- M: Views Graph 1: Summary of Impact Case Employment Projections
- N: Views Graph 2: Summary of Impact Case Population Projections
- O: Views Graph 3: Impact Case and Base Case Employment Projections
- P: Views Graph 4: Impact Case and Base Case Population Projections
- W: Prints Table 1: Impact Case Projections, as print file table1.prn
- Q: Prints Table 2: Base Case Projections, as print file table2.prn
- R: Prints Table 3: Summary of Impacts, as print file table3.prn
- S: Views Table 1: Impact Case Projections
- T: Views Table 2: Base Case Projections
- V: Views Table 3: Summary of Impacts

VARIABLE		1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
<b>EMPLOYMENT SUMMARY</b>	Total employment	1264	1529	1212	1164	897	884	959	1186	1397	1682
<b>BY INDUSTRY</b>	Fish harvesting	50	50	50	50	50	50	50	50	50	50
	Mining	0	0	0	0	0	0	0	0	0	0
	Construction	5	12	21	16	23	13	14	9	15	13
	Manufacturing	956	1141	793	742	516	515	601	785	931	1105
	Trans., comm. and utilities	34	64	83	97	69	67	72	82	115	179
	Wholesale trade	2	2	3	5	5	3	1	4	6	9
	Retail trade	62	72	67	60	54	59	65	87	105	118
	Fin., ins. and real estate	28	36	42	23	26	24	26	25	25	25
	Services	16	16	6	4	5	8	5	12	11	20
	Miscellaneous	7	7	11	22	21	13	3	16	23	38
	Federal government	20	20	17	15	13	15	14	10	8	6
	State government	2	5	7	11	14	11	7	4	6	6
	Local government	82	104	112	119	101	106	101	102	102	113
<b>EMPLOYMENT SUMMARY</b>	Total	1264	1529	1212	1164	897	884	959	1186	1397	1682
<b>BY RESIDENCY</b>	Total resident	356	445	459	459	407	395	388	440	513	632
	Resident OCS	0	0	0	0	0	0	0	0	0	0
	Resident Non-OCS	356	445	459	459	407	395	388	440	513	632
	Total enclave	908	1084	753	705	490	489	571	746	884	1050
<b>EMPLOYMENT SUMMARY</b>	Total	1264	1529	1212	1164	897	884	959	1186	1397	1682
<b>BY ORIGIN</b>	Total exogenous	1044	1239	892	844	613	612	694	877	1031	1225
	Exogenous resident	136	155	138	139	123	123	123	131	146	175
	Exogenous enclave	908	1084	753	705	490	489	571	746	884	1050
	Total endogenous	220	290	321	320	284	272	265	310	366	457
	Enclave-driven	137	184	185	179	142	136	142	182	220	275
	Resident exogenous-driven	82	106	136	141	142	136	123	128	146	183
<b>EMPLOYMENT SUMMARY</b>	Total	1264	1529	1212	1164	897	884	959	1186	1397	1682
<b>BY SECTOR</b>	Basic	1006	1191	843	792	566	565	651	835	981	1155
	Support	154	209	233	227	203	187	186	235	300	402
	Government	104	129	136	145	128	132	122	116	116	125
<b>POPULATION SUMMARY</b>	Total (resident and enclave)	1632	1944	1992	1677	1447	1331	1354	1634	1908	2265
	Enclave population	908	1084	753	705	490	489	571	746	884	1050
	Resident population	724	860	1239	972	957	842	783	888	1024	1215
	School age	162	195	190	175	152	135	138	145	151	187
	Native	200	204	208	212	216	221	225	230	234	239
	Non-Native	524	656	1031	760	740	621	558	659	789	976

1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1959	2244	2528	2528	2528	2528	2528	2528	2528	2528	2528
50	50	50	50	50	50	50	50	50	50	50
0	0	0	0	0	0	0	0	0	0	0
15	17	19	19	19	19	19	19	19	19	19
1300	1500	1700	1700	1700	1700	1700	1700	1700	1700	1700
208	238	268	268	268	268	268	268	268	268	268
10	12	13	13	13	13	13	13	13	13	13
137	156	176	176	176	176	176	176	176	176	176
29	33	37	37	37	37	37	37	37	37	37
24	27	31	31	31	31	31	31	31	31	31
44	50	56	56	56	56	56	56	56	56	56
6	6	6	6	6	6	6	6	6	6	6
6	6	6	6	6	6	6	6	6	6	6
130	148	166	166	166	166	166	166	166	166	166
1959	2244	2528	2528	2528	2528	2528	2528	2528	2528	2528
724	819	913	913	913	913	913	913	913	913	913
0	0	0	0	0	0	0	0	0	0	0
724	819	913	913	913	913	913	913	913	913	913
1235	1425	1615	1615	1615	1615	1615	1615	1615	1615	1615
1959	2244	2528	2528	2528	2528	2528	2528	2528	2528	2528
1431	1643	1855	1855	1855	1855	1855	1855	1855	1855	1855
196	218	240	240	240	240	240	240	240	240	240
1235	1425	1615	1615	1615	1615	1615	1615	1615	1615	1615
528	601	673	673	673	673	673	673	673	673	673
323	373	422	422	422	422	422	422	422	422	422
205	228	251	251	251	251	251	251	251	251	251
1959	2244	2528	2528	2528	2528	2528	2528	2528	2528	2528
1350	1550	1750	1750	1750	1750	1750	1750	1750	1750	1750
467	533	600	600	600	600	600	600	600	600	600
142	160	178	178	178	178	178	178	178	178	178
2899	3307	3714	3714	3714	3714	3714	3714	3714	3714	3714
1235	1425	1615	1615	1615	1615	1615	1615	1615	1615	1615
1664	1882	2099	2099	2099	2099	2099	2099	2099	2099	2099
256	290	323	323	323	323	323	323	323	323	323
244	249	254	259	264	269	275	280	286	291	297
1420	1633	1846	1841	1835	1830	1825	1819	1814	1808	1802

<b>EXOGENOUS EMPLOYMENT ASSUMPTIONS</b>	Fish harvesting (resident, exog.)	50	50	50	50	50	50	50	50	50	50
	Mining: total (exogenous)	0	0	0	0	0	0	0	0	0	0
	Non-OCS resident	0	0	0	0	0	0	0	0	0	0
	OCS resident	0	0	0	0	0	0	0	0	0	0
	OCS enclave	0	0	0	0	0	0	0	0	0	0
<b>OCS Employment Totals</b>	Onshore short-term skilled	0	0	0	0	0	0	0	0	0	0
	Onshore short-term non-skilled	0	0	0	0	0	0	0	0	0	0
	Onshore long-term skilled	0	0	0	0	0	0	0	0	0	0
	Onshore long-term non-skilled	0	0	0	0	0	0	0	0	0	0
	Offshore short-term skilled	0	0	0	0	0	0	0	0	0	0
	Offshore short-term non-skilled	0	0	0	0	0	0	0	0	0	0
	Offshore long-term skilled	0	0	0	0	0	0	0	0	0	0
	Offshore long-term non-skilled	0	0	0	0	0	0	0	0	0	0
<b>OCS Employment Resident Share</b>	Onshore short-term skilled	0	0	0	0	0	0	0	0	0	0
	Onshore short-term non-skilled	0	0	0	0	0	0	0	0	0	0
	Onshore long-term skilled	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	Onshore long-term non-skilled	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	Offshore short-term skilled	0	0	0	0	0	0	0	0	0	0
	Offshore short-term non-skilled	0	0	0	0	0	0	0	0	0	0
	Offshore long-term skilled	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Offshore long-term non-skilled	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
<b>OCS Employment Enclave Share</b>	Onshore short-term skilled	1	1	1	1	1	1	1	1	1	1
	Onshore short-term non-skilled	1	1	1	1	1	1	1	1	1	1
	Onshore long-term skilled	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	Onshore long-term non-skilled	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	Offshore short-term skilled	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	Offshore short-term non-skilled	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	Offshore long-term skilled	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Offshore long-term non-skilled	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
<b>OCS Local Government</b>	Local government employment supported by OCS revenues	0	0	0	0	0	0	0	0	0	0
	Manufacturing: total	956	1141	793	742	516	515	601	785	931	1105
	Resident fish processing (exog.)	48	57	40	37	26	26	30	39	47	55
	Enclave fish processing	908	1084	753	705	490	489	571	746	884	1050
	Resident share	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
	Federal government (exogenous)	20	20	17	15	13	15	14	10	8	6
	State government (exogenous)	2	5	7	11	14	11	7	4	6	6
<b>ENDOGENOUS EMPLOYMENT CALCULATIONS</b>	Emp. in sectors with endog. emp.	236	313	345	346	304	293	287	337	402	515
	Construction	5	12	21	16	23	13	14	9	15	13
	Trans., comm. and utilities	34	64	83	97	69	67	72	82	115	179
	Wholesale trade	2	2	3	5	5	3	1	4	6	9
	Retail trade	62	72	67	60	54	59	65	87	105	118
	Fin., ins. and real estate	28	36	42	23	26	24	26	25	25	25
	Services	16	16	6	4	5	8	5	12	11	20
	Miscellaneous	7	7	11	22	21	13	3	16	23	38
	Local government	82	104	112	119	101	106	101	102	102	113
	Exog. share of emp. in these sect's										
	Construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Trans., comm. and utilities	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
	Wholesale trade	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Retail trade	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
	Fin., ins. and real estate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Services	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.50
	Miscellaneous	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Local government	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

50	50	50	50	50	50	50	50	50	50	50	50
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1	1	1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1	1	1
0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
0	0	0	0	0	0	0	0	0	0	0	0
1300	1500	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
65	75	85	85	85	85	85	85	85	85	85	85
1235	1425	1615	1615	1615	1615	1615	1615	1615	1615	1615	1615
0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
6	6	6	6	6	6	6	6	6	6	6	6
6	6	6	6	6	6	6	6	6	6	6	6
597	682	766	766	766	766	766	766	766	766	766	766
15	17	19	19	19	19	19	19	19	19	19	19
208	238	268	268	268	268	268	268	268	268	268	268
10	12	13	13	13	13	13	13	13	13	13	13
137	156	176	176	176	176	176	176	176	176	176	176
29	33	37	37	37	37	37	37	37	37	37	37
24	27	31	31	31	31	31	31	31	31	31	31
44	50	56	56	56	56	56	56	56	56	56	56
130	148	166	166	166	166	166	166	166	166	166	166
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.10	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.51	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00



Exog. emp. in these sectors										
	Construction	0	0	0	0	0	0	0	0	0
	Trans., comm. and utilities	7	13	17	19	14	13	14	16	23
	Wholesale trade	0	0	0	0	0	0	0	0	0
	Retail trade	6	7	7	6	5	6	7	9	11
	Fin., ins. and real estate	0	0	0	0	0	0	0	0	0
	Services	3	3	1	1	1	2	1	2	10
	Miscellaneous	0	0	0	0	0	0	0	0	0
	Local government	0	0	0	0	0	0	0	0	0
Endogenous employment										
	Construction	220	290	321	320	284	272	265	310	366
	Trans., comm. and utilities	5	12	21	16	23	13	14	9	15
	Wholesale trade	27	51	66	78	55	54	58	66	92
	Retail trade	2	2	3	5	5	3	1	4	6
	Fin., ins. and real estate	56	65	60	54	49	53	59	78	95
	Services	28	36	42	23	26	24	26	25	25
	Miscellaneous	13	13	5	3	4	6	4	10	9
	Local government	7	7	11	22	21	13	3	16	23
		82	104	112	119	101	106	101	102	102
Share of endogenous employment										
	Construction	0.02	0.04	0.07	0.05	0.08	0.05	0.05	0.03	0.04
	Trans., comm. and utilities	0.12	0.18	0.21	0.24	0.19	0.20	0.22	0.21	0.25
	Wholesale trade	0.01	0.01	0.01	0.02	0.02	0.01	0.00	0.01	0.02
	Retail trade	0.25	0.22	0.19	0.17	0.17	0.20	0.22	0.25	0.26
	Fin., ins. and real estate	0.13	0.12	0.13	0.07	0.09	0.09	0.10	0.08	0.07
	Services	0.06	0.04	0.01	0.01	0.01	0.02	0.02	0.03	0.02
	Miscellaneous	0.03	0.02	0.03	0.07	0.07	0.05	0.01	0.05	0.06
	Local government	0.37	0.36	0.35	0.37	0.36	0.39	0.38	0.33	0.28
Share of endog. employ. gen. by:										
	Resident exogenous employment	82	106	136	141	142	136	123	128	146
	Enclave employment	137	184	185	179	142	136	142	182	220
	Assumed ratio of resident multiplier to enclave multiplier	4	4	4	4	4	4	4	4	4
	Resident multiplier	0.61	0.68	0.98	1.01	1.16	1.11	1.00	0.98	1.00
	Enclave multiplier	0.15	0.17	0.25	0.25	0.29	0.28	0.25	0.24	0.25
	Ratio of multipliers to 1989	0.58	0.65	0.94	0.97	1.10	1.06	0.95	0.93	0.95
POPULATION ASSUMPTIONS AND CALCULATIONS										
	Enclave population	908	1084	753	705	490	489	571	746	884
	Resident employment	356	445	459	459	407	395	388	440	513
	Resident pop. ratio (pop/emp)	2.03	1.93	2.70	2.12	2.35	2.13	2.02	2.02	2.00
	Ratio of res. pop. ratio to 1990	0.89	0.84	1.17	0.92	1.02	0.93	0.88	0.88	0.87
	Resident population	724	860	1239	972	957	842	783	888	1024
	Total pop., enclave plus resident	1632	1944	1992	1677	1447	1331	1354	1634	1908
	Resident population: total	724	860	1239	972	957	842	783	888	1024
	School-age (5-18)	162	195	190	175	152	135	138	145	151
	Other	562	665	1049	797	805	707	645	743	873
	Ratio of school-age to total	0.22	0.23	0.15	0.18	0.16	0.16	0.18	0.16	0.15
	Native pop. growth rate	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020
	Native population: total	200	204	208	212	216	221	225	230	234
	Non-Native population: total	524	656	1031	760	740	621	558	659	789

0	0	0	0	0	0	0	0	0	0	0
43	50	57	57	57	57	57	57	57	57	57
0	0	0	0	0	0	0	0	0	0	0
14	17	20	20	20	20	20	20	20	20	20
0	0	0	0	0	0	0	0	0	0	0
12	14	16	16	16	16	16	16	16	16	16
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
528	601	673	673	673	673	673	673	673	673	673
15	17	19	19	19	19	19	19	19	19	19
165	188	211	211	211	211	211	211	211	211	211
10	12	13	13	13	13	13	13	13	13	13
123	139	156	156	156	156	156	156	156	156	156
29	33	37	37	37	37	37	37	37	37	37
12	13	15	15	15	15	15	15	15	15	15
44	50	56	56	56	56	56	56	56	56	56
130	148	166	166	166	166	166	166	166	166	166
0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31
0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
205	228	251	251	251	251	251	251	251	251	251
323	373	422	422	422	422	422	422	422	422	422
4	4	4	4	4	4	4	4	4	4	4
1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05
0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26
1	1	1	1	1	1	1	1	1	1	1
1235	1425	1615	1615	1615	1615	1615	1615	1615	1615	1615
724	819	913	913	913	913	913	913	913	913	913
2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1664	1882	2099	2099	2099	2099	2099	2099	2099	2099	2099
2899	3307	3714	3714	3714	3714	3714	3714	3714	3714	3714
1664	1882	2099	2099	2099	2099	2099	2099	2099	2099	2099
256	290	323	323	323	323	323	323	323	323	323
1408	1592	1776	1776	1776	1776	1776	1776	1776	1776	1776
0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020
244	249	254	259	264	269	275	280	286	291	297
1420	1633	1846	1841	1835	1830	1825	1819	1814	1808	1802

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interest of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. Administration.

