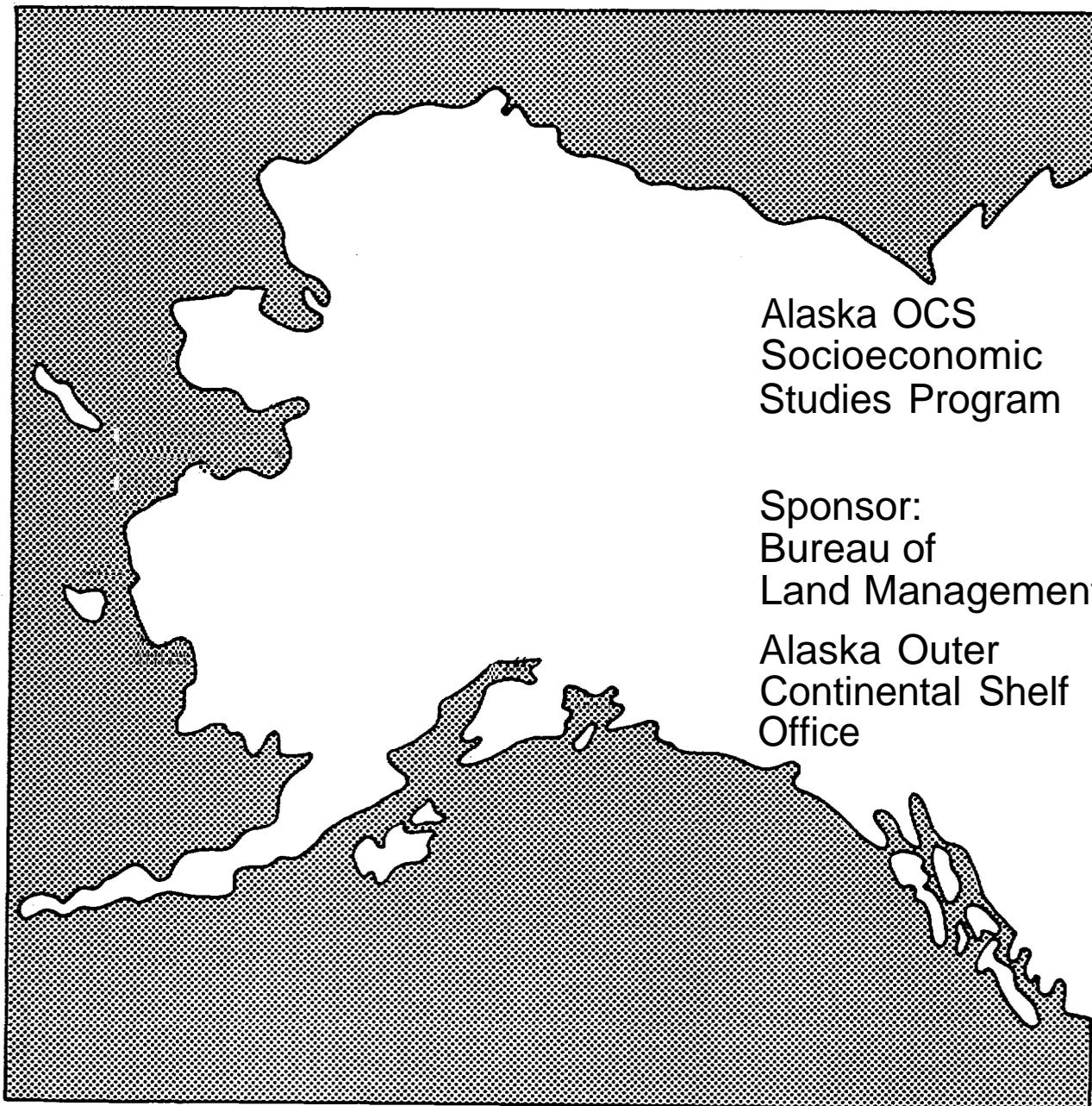


Technical Report Number 1



Alaska OCS
Socioeconomic
Studies Program

Sponsor:
Bureau of
Land Management

Alaska Outer
Continental Shelf
Office

Definition of Alaska Petroleum Development Regions

The United States Department of the Interior was designated by the Outer Continental Shelf (OCS) Lands Act of 1953 to carry out the majority of the Act's provisions for administering the mineral leasing and development of offshore areas of the United States under federal jurisdiction. Within the Department, the Bureau of Land Management (BLM) has the responsibility to meet requirements of the National Environmental Policy Act of 1969 (NEPA) as well as other legislation and regulations dealing with the effects of offshore development. In Alaska, unique cultural differences and climatic conditions create a need for developing additional socioeconomic and environmental information to improve OCS decision making at all governmental levels. In fulfillment of its federal responsibilities and with an awareness of these additional information needs, the BLM has initiated several investigative programs, one of which is the Alaska OCS Socioeconomic Studies Program.

The Alaska OCS Socioeconomic Studies Program is a multi-year research effort which attempts to predict and evaluate the effects of Alaska OCS Petroleum Development upon the physical, social, and economic environments within the state. The analysis addresses the differing effects among various geographic units: the State of Alaska as a whole, the several regions within which oil and gas development is likely to take place, and within these regions, the various communities.

The overall research method is multidisciplinary in nature and is based on the preparation of three research components. In the first research component, the internal nature, structure, and essential processes of these various geographic units and interactions among them are documented. In the second research component, alternative sets of assumptions regarding the location, nature, and timing of future OCS petroleum development events and related activities are prepared. In the third research component, future oil and gas development events are translated into quantities and forces acting on the various geographic units. The predicted consequences of these events are evaluated in relation to present goals, values, and expectations.

In general, program products are sequentially arranged in accordance with BLM's proposed OCS lease sale schedule, so that information is timely to decision making. In addition to making reports available through the National Technical Information Service, the BLM is providing an information service through the Alaska OCS Office. Inquiries for information should be directed to: Program Coordinator (COAR), Socioeconomic Studies Program, Alaska OCS Office, P. O. Box 1159, Anchorage, Alaska 99510.

TECHNICAL REPORT No. 1

CONTRACT NO. AA550-CT6-61

ALASKA OCS SOCIOECONOMIC STUDIES PROGRAM

DEFINITION OF ALASKA PETROLEUM
DEVELOPMENT REGIONS

PREPARED FOR

BUREAU OF LAND MANAGEMENT
ALASKA OUTER CONTINENTAL SHELF OFFICE

DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE
NATIONAL TECHNICAL INFORMATION SERVICE
5285 PORT ROYAL ROAD
SPRINGFIELD, VIRGINIA 22161

NOTICE

This document is disseminated **under** the sponsorship of the U.S. Department of the Interior, Bureau of Land Management, Alaska Outer Continental Shelf (OCS) Office, in the interest of information exchange. The U.S. Government assumes no liability for its content or use thereof.

ALASKA OCS SOCIOECONOMIC STUDIES PROGRAM
DEFINITION OF ALASKA PETROLEUM DEVELOPMENT REGIONS

Prepared by
PEAT, MARWICK, MITCHELL & CO., URSA, CCC/HOK and DAMES & MOORE

1. Report No. Technical Report No. 1	2.	3. Recipient's Accession No.	
4. Title and subtitle Alaska OCS Socioeconomic Studies Program Definition of Alaska Petroleum Development Regions		5. Report Date August 1978	
7. Author(s)		8. Performing Organization Report No.	
9. Performing Organization Name and Address Peat, Marwick, Mitchell & Co., URSA, CCC/HOK and Dames & Moore 601 W. 5th Street Anchorage, Alaska 99510		10. Project/Task/Work Unit no.	
12. Sponsoring Organization Name and Address Bureau of Land Management Alaska Outer Continental Shelf Office P.O. Box 1159 Anchorage, Alaska 99510		11. Contract or Grant No. AA550-CT6-61	
5. Supplementary Notes		13. Type of Report	
6. Abstract <p>The purpose of this report is to define boundaries for Petroleum Development Regions in Alaska. These boundaries provide initial data-gathering and impact analysis areas which will be refined and altered as Petroleum Development Scenarios and other research products become available. The boundaries defined in this report generally accord with those of Native Corporations in onshore areas adjacent to lease-sale areas; however, they are further modified to accord with certain labor, census, and political boundaries.</p>			
17. Originator's Key Words Alaska, OCS Development, Socioeconomic Data, Petroleum Development Regions		18. Availability Statement National Technical Information Service 5285 Port Royal Road Springfield, VA 22161	
19. U. S. Security Classif. of the Report Unclassified	20. U. S. Security Classif. of This Page Unclassified	21. No. of Pages	22. Price

1950

1950

TABLE OF CONTENTS

I.	INTRODUCTION	1
II.	METHOD	3
	OCS Development	3
	Socioeconomic Systems	9
	Conclusions	16
III.	PETROLEUM DEVELOPMENT REGIONS	19
	Gulf of Alaska Macro-Region	20
	NORTH GULF OF ALASKA REGION	34
	LOWER COOK INLET REGION	37
	KODIAK REGION	40
	Beaufort Sea Region	43
	ASSOCIATED IMPACT AREAS	52
	Anchorage	53
	Fairbanks	54
	Bering-Norton Region	57
	Bering-St. George Region	61
	Kodiak-Alutian Region	64
	REFERENCES	69



LIST OF FIGURES

●	Figure 1 Potential Alaskan Outer Continental Shelf Lease Sale Basins	5
●	Figure 2 Census Divisions and Labor Market Areas for the State of Alaska	14
	Figure 3 Alaska Native Regional Corporation Boundaries	15
●	Figure 4 Gulf of Alaska Macro-Region	21
	Figure 5 Beaufort Sea Petroleum Development Region and Associated Impact Areas	44
●	Figure 6 Bering-Norton Petroleum Development Region	58
	Figure 7 Bering-St. George Petroleum Development Region	62
●	Figure 8 Kodiak-Alutian Petroleum Development Region	65



x



LIST OF TABLES

Table 1
Examples of Traditional and Modern Systems Developed for
Human Survival 11

Table 2
Socioeconomic Data Currently Available Statewide 13

Table 3
Regional Components, North Gulf of Alaska Petroleum
Development Regions* 36

Table 4
Regional Components, Lower Cook Inlet Petroleum
Development Region 39

Table 5
Regional Components, Kodiak Petroleum Development Region 42

Table 6
Regional Components, Beaufort Sea Petroleum Development
Region 56

Table 7
Regional Components, Bering-Norton Petroleum
Development Region 60

Table 8
Regional Components, Bering-St. George Petroleum
Development Region 63

Table 9
Regional Components, Kodiak-Alutian Petroleum
Development Region 67



I. INTRODUCTION

The Alaska OCS Socioeconomic Studies Program is designed to project socioeconomic changes resulting from oil and gas development in identified Outer Continental Shelf (OCS) lease sale basins. The assessment of these changes will require the collection and evaluation of both new and currently available data covering a broad range of topics in different areas of the state. In order to focus immediate program research efforts, it is necessary to define a single set of geographical areas within which new data will be collected and currently available data will be arrayed for comparative purposes. The single definitional consideration is that the resulting set of spatial boundaries encompass the causes and socioeconomic effects of OCS induced changes. The areas contained within these spatial boundaries constitute what the Program will refer to as "Petroleum Development Regions." The intent of this report is to present the conclusions, substance, and method of the definition of these regions.

Defining regions at this early point in the Socioeconomic Studies Program is problematic in that the types and kinds of data needed to conduct the entire study are not yet fully identified. OCS development will require the commitment of physical, social, and economic resources in Alaska which, in turn, will induce changes in a wide range of geographically bounded physical, social, and economic systems. Efforts to evaluate system changes induced by new industrial development are typically based upon quantifiable and readily available data, such as population, income, employment, physical environmental factors, and service systems

characteristics. Where socioeconomic systems are relatively stable and well defined, the use of these data may be adequate to project and evaluate the various changes attributable to OCS activities. To the extent that available data display the various systems, the geographic boundaries drawn around these data will adequately represent these systems. These data and system boundaries will, when compared with the likely geographic boundaries of OCS development activities, generate coherent Petroleum Development Regions.

However Alaska, unlike typical America, is a vast area with many small remote communities whose people have a broad cultural diversity and are intimately dependent on the local physical environment. Some Alaska socioeconomic systems may be considered neither well defined *nor* stable, since such systems are being rapidly altered by major sources of complex change other than OCS. Many Alaska social and economic systems remain to be identified; little or no relevant data may have yet been collected. To adequately address the changes likely to take place as a result of OCS and non-OCS forces in these systems, new kinds of data may have to be gathered. The collection of new data for a newly identified system may cross the boundary of a petroleum development region identified in this report, because the system itself does not conform to the regional boundary. In such cases, the data will be gathered for the system, regardless of the regional boundaries, and in subsequent analysis the regional boundary may need to be adjusted. Therefore, the petroleum development regions identified in this report must be considered as tentative regions used only to guide early data gathering.

II. METHOD

The definition of Petroleum Development Regions within the State of Alaska is being conducted early in the Socioeconomic Studies Program to guide data collection and to facilitate the research necessary to perform other program tasks. This report will also identify impact areas associated with, but not adjacent to, the Beaufort Sea and North Gulf of Alaska lease sale basins, because oil and gas development is expected to occur initially in these areas.

The method used to define petroleum development regions utilizes only readily available data and is based on an analysis of the relationship of OCS development to existing social and economic systems. The lack of thoroughly analyzed data early in the study constrains the discussion; consequently, several assumptions are required. The discussion begins with the character of offshore development and its likely onshore activities. The discussion continues with the general character of social and economic systems in Alaska and the manner in which existing data collection boundaries might represent these systems. The discussion concludes with a brief explanation of the regional analysis process and the data used to define the regions. In the next chapter, the selected boundaries are presented for each region.

OCS Development

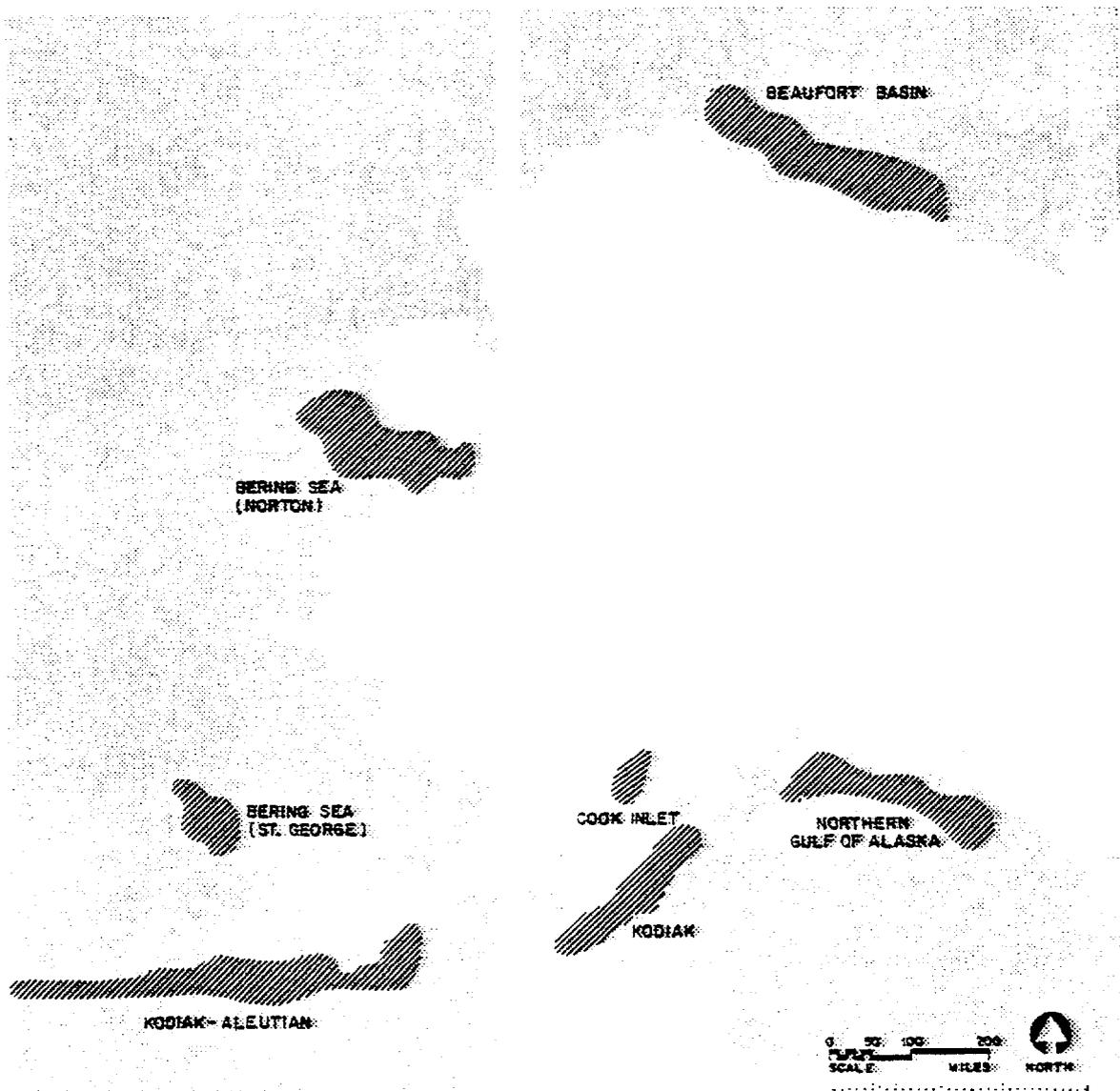
The development of OCS oil and gas resources in Alaska has already begun

and is expected to continue over a period of many years, eventually taking place in many areas of the State. The Bureau of Land Management (BLM) has identified several potential OCS petroleum lease sale basins as shown in **Figure 1**. The areas illustrated in Figure 1 identify the offshore development areas, but do not define either the onshore or offshore areas liable to be affected by OCS development. The extent and timing of onshore and offshore developmental activities will vary with the various stages of oil and gas recovery - exploration, field development, production, and phase-out. The geographic dimensions of these activities are dictated by the nature and location of the resources, physical conditions onshore and offshore, political and economic factors and oil and gas technology, among many other considerations.

Each of the four stages of OCS development has characteristics that influence offshore and onshore activities:

- Exploration The exploration stage is defined to include the pre-lease sale and post-lease sale exploratory activities which seek to discover and assess the specific location, quantity, recoverability, and perimeters of oil and gas resource fields. This stage generally involves:
 - environmental impact studies and public hearings;
 - lease sales;
 - systematic exploratory drilling of tracts within the lease sale area, using jack-up rigs, semi-submersible rigs, or drill ships

FIGURE 1



POTENTIAL ALASKAN OUTER CONTINENTAL
SHELF LEASE SALE BASINS

This stage may require onshore support facilities to assist in the transportation and housing of men and equipment associated with offshore activities. It may also affect the offshore commercial, recreational, or subsistence activities of nearby communities.

Wherever possible and economically feasible, industry is expected to locate onshore support facilities in existing coastal communities that have needed resources and operational infrastructures and services. Thus, the anticipatory nature of exploration is also expected to contribute to socioeconomic changes.

- Development If sufficient recoverable petroleum resources are discovered through exploration, industry may decide to proceed with development of the field. This stage generally involves:
 - the drilling of production wells, commonly using giant steel or concrete platforms
 - the development of offshore storage, dehydration, compression, and separation facilities and transportation modes to move the products to shore or where tankers may moor to take on oil
- the development of onshore storage facilities, ports, or pipelines

This stage may require the acquisition of considerable onshore land area, the construction of support facilities, the stockpiling of material resources, and the development of labor resources, all depending on the technology used for extracting or transporting oil and/or gas from each lease sale area. Economic advantages are gained during the development stage by having direct supply lines of men and material to the field as well as by developing the shortest distance lines to gather the oil from a large field together at a central point prior to placement in pipelines or tankers for delivery to oil markets. Based on the generalized experience of OCS petroleum development in other non-industrialized rural areas, a distance of 200 miles from offshore activities was felt to be adequate to represent the distance to the most remote onshore support facilities. Thus, inland communities, unless situated on navigable rivers or bays are not likely to be directly affected by offshore support activities.

- Production This stage involves the continuous production and transportation of oil and gas resources, which may continue for twenty or more years. Of special concern during this stage are the maintenance of sufficient pressure to bring the resource to the surface; prevention of blowouts, spills, and leakages; efficient disposal of wastes; and monitoring of all production functions.

This stage may require long-term storage facilities to support

offshore activities and support services for workers and their families. It may also result in employment opportunities for local communities as well as considerable revenue for both regional and state governments.

- Phase-Out When the mineral resource ceases to be economically or technically recoverable (due, for example, to loss of pressure), industry closes down its production operations, which involves the plugging and abandonment of wells. Depending on the various uses to which onshore facilities and equipment may be put and arrangements made between the petroleum industry and others for their use phase-down may or may not result in local economic and labor market declines.

From a brief analysis of offshore development activities in the United States and the North Sea, it is apparent that there are two general types of onshore impact which together define the petroleum development region boundary:

- Direct Direct impacts result from the location of onshore support facilities or resources (e.g., staging areas, supply depots, storage facilities, transshipment facilities, etc.), in or near a community or site. Based on the earlier discussions of the various stages of OCS development, the size of potential "direct" impact areas is limited by the 200 mile criterion discussed earlier. It is further limited and refined based on petroleum

development scenarios. Petroleum Development scenarios detail hypothetical industrial logistics, employment, facilities, and equipment most appropriate for levels and locations of oil and gas. Regions of direct impact only do not, however, necessarily reflect the geographic universe of socioeconomic linkages affected by development.

- Associated Associated impacts are those on a community, site, area, or population that result from a direct impact on another **community**, site, area, or population. The criterion upon which associated impact areas are defined is the extent to which patterns of economic, cultural, social, political, and physical interaction are known to exist and the extent to which services are centralized or decentralized. Consequently, the identification of "associated" impact areas occurs after the "direct" impact areas are identified and after external socioeconomic linkages of directly impacted areas are better understood.

Socioeconomic Systems

Various socioeconomic systems can be viewed as interacting within a circumscribed "universe," which includes both the natural and social environments.

Changes in these environments may require adjustments in the various systems that exist within this universe.

Systems necessary for the maintenance of human society include those which provide food, protection from the environment, social integration, and the perpetuation of society. In many parts of Alaska, the systems which have developed traditionally to carry out these functions are quite different from those which exist typically in the United States. This difference is attributable in varying degrees, to differences in natural environments, social environments, and technology.

Since most of Alaska is occupied by groups of persons who are in the process of social, economic, and cultural change, it is important to consider both the "traditional" and the "modern" systems developed to carry out the functions necessary for the survival of human groups. Four such functions are illustrated in Table 1.

In order to adequately analyze change in these and other systems, it is necessary to know how each system functions. This is probably easier for the "modern" systems because they tend to be more formal and have written rules, and because most researchers are more familiar with the "modern" systems. Understanding "traditional" systems may be more difficult, since little information about "traditional" systems in Alaska has been developed.

While the Socioeconomic Studies Program is defining program boundaries in order to direct data collection, the understanding of both "traditional" and "modern" systems for this study must come from data already assembled by others. Several types of socioeconomic data currently available state-

TABLE 1

EXAMPLES OF TRADITIONAL AND MODERN
SYSTEMS DEVELOPED FOR HUMAN SURVIVAL

<u>Societal Function</u>	<u>Traditional systems</u>	<u>Modern Systems</u>
Procuring food	Subsistence Economy Hunting Fishing Gathering vegetable matter Making tools Trading	Cash Economy Wage employment Trapping, cottage industry Transfer payments from state or federal gov't. Purchasing items from stores Transportation of items to stores Communication
Protection from Environment	Obtain natural materials to make clothing, shelter Heat from wood or animal oil	Purchase clothing Purchase shelter, or obtain through gov't. programs Purchase fuel oil
Social Integration	Social system provides for education of young, selection of leaders, and conformity to acceptable behavior	Formal systems of Education Government Law enforcement Religion
Perpetuation of Society	Health care practices Social system includes relationships with other groups to provide suitable partners for marriage and alliance for defense of group	Health care delivery systems Military Mobility, through greater transportation and communication which tends to reduce social structure for selection of marriage partners; but there is a larger pool from which to select

wide are identified in Table 2. These existing data are limited by geographical boundaries, which may or may not be related to social and cultural systems or to potential OCS development activity. Nevertheless, use of such data requires implicit recognition of certain geographical regions as suggested by Table 2 and Figures 2 and 3. In some cases, the geographical regions encompassing diverse sources of data may be the same. For example, census divisions are often used as a geographical boundary for data collection by agencies other than the Bureau of the Census. In other cases, agencies keep records according to the administrative units in which they are organized, few of which may correspond with other geographical areas. In addition, data are often collected at the local level, providing information about school enrollments, arrests by the local police, sales tax revenues, property valuations, amount of solid waste disposal, etc.

Although regions used by the various agencies may not be very **useful** to this study, often the raw data may be obtained and organized into more appropriate regions. However, herein lies an explicit tradeoff in selecting one regional boundary over another. If the raw data cannot be obtained and reorganized, some data may be useless or may require questionable assumptions and procedures to make them conform to the selected boundary.

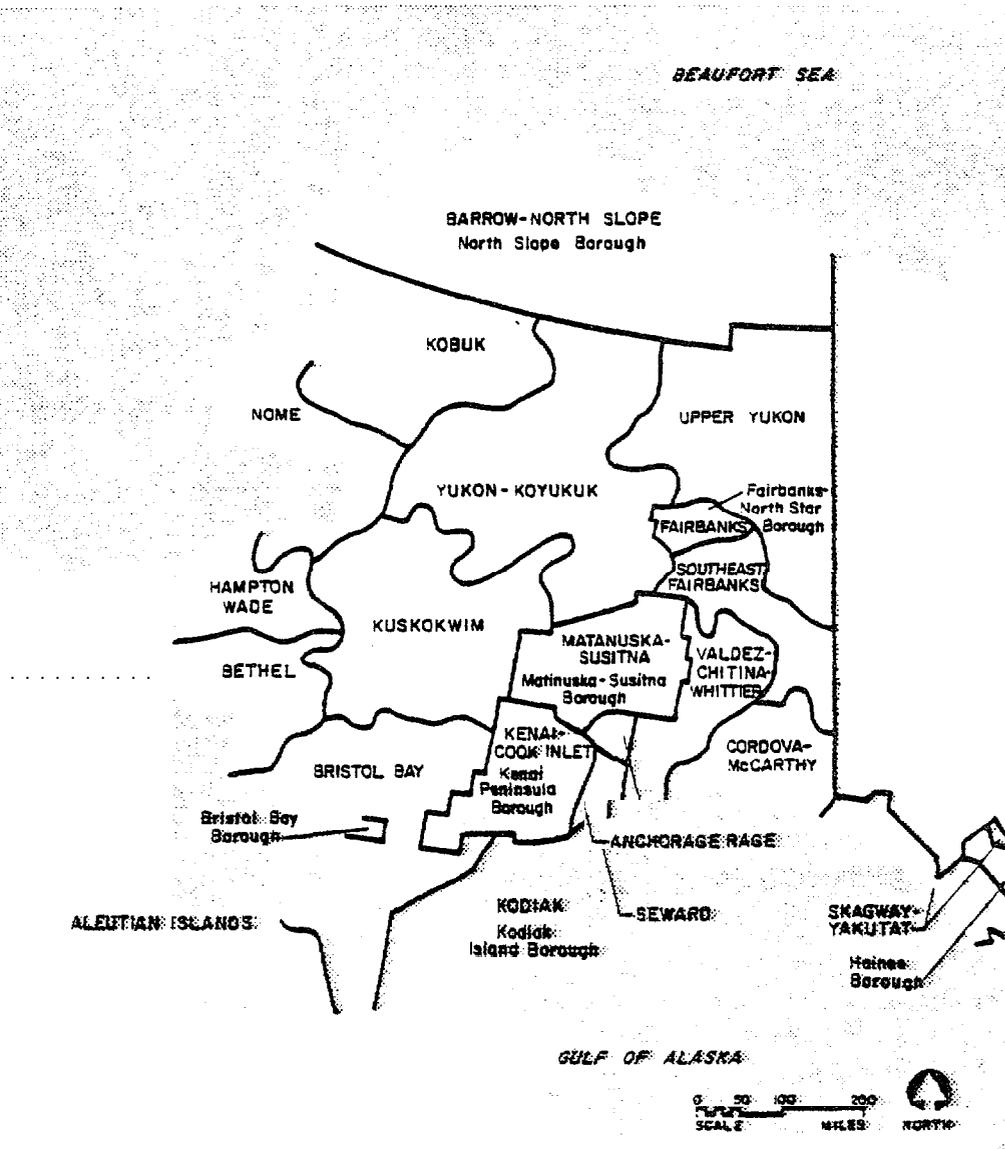
The analysis of available data revealed that the most stable and uniform **georecorded** data existing within Alaska are organized into three categories:

SOCIOECONOMIC DATA CURRENTLY AVAILABLE STATEWIDE

<u>Source of Data</u>	<u>Type of Data</u>	<u>Region</u>
U. S. Census	Population Sociological data Housing Economic characteristics	Census Districts Standard Metropolitan Statistical Areas (SMSA)
U. S. Bureau of Indian Affairs	Population ANCSA enrollments	Native Regional Corp. areas Villages
Joint Federal-State Land Use Planning Commission	Availability of resources	Six regions
Alaska Department of Labor	Employment Population Labor force	Labor Market Regions Census Districts
Alaska Department of Health and Social Services, Division of Vital Statistics	Births Deaths Marriages Divorces Abortions Categorical assistance caseloads Numbers of foodstamp recipients State laboratory test results	Judicial Districts Census Districts
Ak. Dept. of Public Safety	State Trooper arrests by crime	Agency Administrative Units
Ak. Dept. of Revenue	Gallons of alcoholic beverages sold Gallons of fuel oil sold Numbers, types, and locations of new businesses	Agency Administrative Units
U. S. Public Health Service, Alaska Area Native Health Service	Epidemiological information on Alaska Natives	Agency Administrative Units

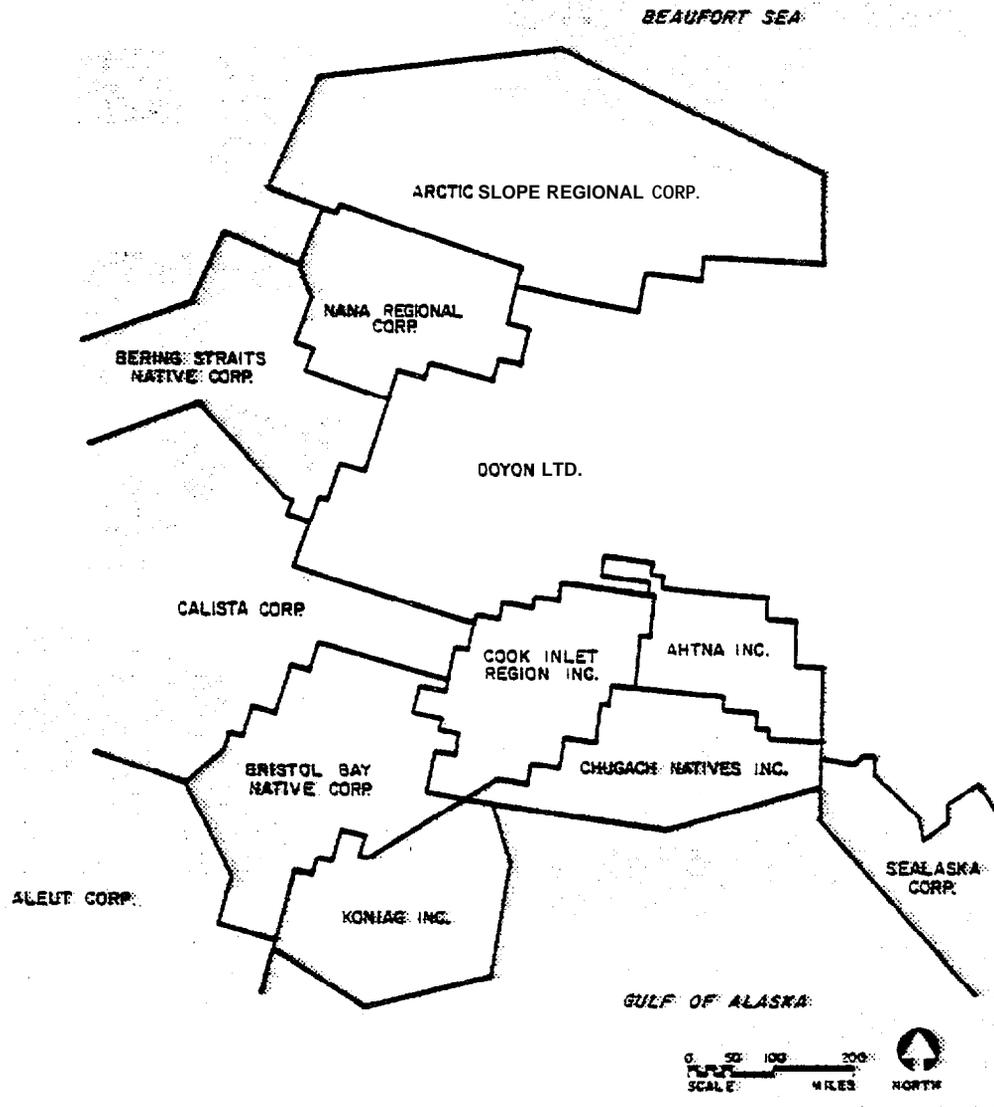
(Source: M. Dixon)

FIGURE 2



CENSUS DIVISIONS AND LABOR MARKET AREAS FOR THE STATE OF ALASKA

FIGURE 3



ALASKA NATIVE REGIONAL CORPORATION BOUNDARIES

- Population and labor statistics
- Topographic and hydrologic features
- Governance

Analysis of the relationships among these three categories revealed that governance boundaries most often subsumed the boundaries based on the remaining categories. In particular, the boundaries of the Native Regional Corporations as shown in Figure 3 appeared to systematically reflect a range of factors including and in addition to those listed above; in fact, Native Regional Corporation boundaries were originally developed to reflect cultural homogeneity based on traditional use and settlement patterns which often result from topographic and hydrologic barriers.

Similarly, regional corporations are **taking on** increasing significance as each becomes more involved in such functions as land use planning, service delivery, local village planning and technical assistance, and socioeconomic data collection.

Conclusions

The Program's definition of petroleum development regions is based on socioeconomic systems criteria implicit in the concept of "direct" and "associated" impact areas. The linkages among various socioeconomic systems will often transcend the boundary of the direct impact area. While the direct impact of petroleum development activities may be contained within a 200 mile radius onshore, the associated impact area may be

larger, smaller, or different than the direct impact area. Associated impacts may involve all or only some of the socioeconomic system linkages among a **given** people. The boundaries around such linkages require consideration of several definitional criteria simultaneously, i.e. "direct impacts;" "associated" impacts; location of OCS basins in relation to adjacent coastal communities and important natural resources; geographic bounds of current or evolving known socioeconomic and cultural linkages; established political or related units; and current data collection and analysis units. The boundaries resulting from such consideration are a compromise product, the compromises based on perceived utility to the Socioeconomic Studies Program.

The most logical set of boundaries in Alaska with which to begin investigation was found to be the Alaska Native Regional Corporation boundaries, since they blend many physiographic and cultural factors and represent the product of a considerable amount of socioeconomic research. However, the Regional Corporation boundaries represent traditional socioeconomic systems. The boundaries do not necessarily include the shifts in culture, demography, and economy toward more modern systems. To the extent that existing data and knowledge allowed, the regional boundaries have already been adjusted to account for perceived modern social systems and economies. Users of this report must bear in mind that, throughout this report, the attempt was made not to disaggregate Alaska into petroleum development regions but to define such regions based on expected direct and associated impacts on socioeconomic systems. Initial definition of boundaries was premised on the argument that impacts would not exceed these limits.

However, as the petroleum development scenarios provide a more detailed picture of direct impacts and socioeconomic investigation provides a more detailed picture of associated impacts, it is anticipated that the boundary for much of the impact analysis will be considerably smaller, in the main, than the initial boundary. For example, it is conceivable that, in some remote localities, the effects of certain kinds of development will not intercept major socioeconomic linkages.

Thus, where offshore development is expected to affect one or more communities in an onshore area, the appropriate Native Corporation regional boundary will define an initial study area. Should communities of two or more adjacent Regional Corporations be identified, the initial petroleum development region will be **coterminous** with all their boundaries.

The resulting seven petroleum development regions are discussed in the next chapter.

III. PETROLEUM DEVELOPMENT REGIONS

In this chapter, the petroleum development regions proposed for use by the Socioeconomic Studies Program are identified and described in terms of their location and boundaries, major hydrologic and topographic features, population characteristics, patterns of community interaction, and governance boundaries, based on the methods and criteria defined in the previous chapter. Additional detail is provided for regions associated with lease-sale basins in the Gulf of Alaska and Beaufort Sea in terms of type of government, population size, ethnic and sociocultural characteristics of the population, economic base, available OCS related facilities and resources, and current OCS related activities.

This chapter is organized to present the Petroleum Development Regions in the following order:

- o Gulf of Alaska Macro-Region, containing

- North Gulf of Alaska Region

- Lower Cook Inlet Region

- Kodiak Region

- Beaufort Sea Region

- Bering-Norton Region

- Bering-St. George Region

- Kodiak-Alutian Region

The Gulf of Alaska Macro-Region was defined to acknowledge the

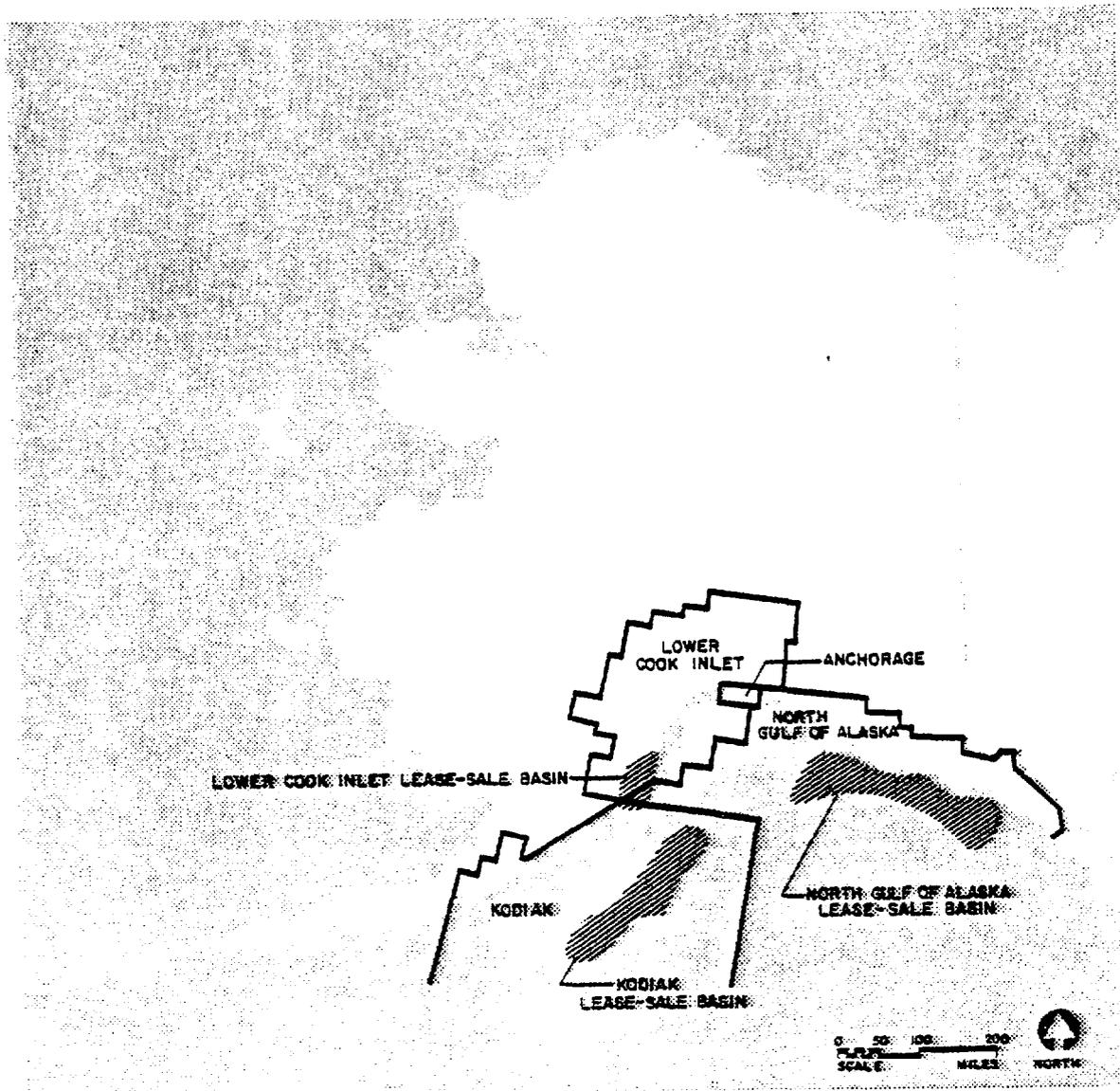
uncertainties of petroleum development **likely** to occur in the three lease sale basins. For example, development in the Northern Gulf may not affect Kodiak Island communities while development in the Kodiak Basin may rely on both Northern Gulf and Cook Inlet communities. Conversely, impacts on a major fishery may affect the fishing industry **of** the entire Gulf and should be examined as a totality. It is likely that the Macro-Region will be investigated as three distinct regions for parsimony and efficiency in data collection and impact projection. It is also likely that detailed petroleum development scenarios will cause refinement and possible alteration of boundaries within the Macro-Region.

The **reader** will note that the Beaufort Sea Region is the only region based, in part, on an advanced analysis of associated impacts. This analysis was completed early in the history of the Program (based on the schedule of lease sales) and was, thus, available at the writing of this report. As research continues in other areas, other regions may be similarly augmented or altered based on more detailed knowledge.

Gulf of Alaska Macro-Region

The Gulf of Alaska Macro-Region is shown in Figure 4. The **Macro-Region** consists of three Petroleum Development Regions associated with three lease sale basins--North Gulf of Alaska, Lower Cook Inlet, and Kodiak. Much of the **detail** for each of these regions are presented in the following description of the Macro-Region. Additional detail is provided in descriptions of individual regions. The Macro-Region boundary is generally

FIGURE 4



GULF OF ALASKA MACRO-REGION

coterminous with those of three Native Regional Corporations (**Chugach, Cook Inlet, Koniag**) and small portions of three others (Bristol Bay, **Aleutian-Pribiloff, Sealaska**). The Macro-Region subsumes the following census divisions:

- **Skagway-Yakutat**
- **Cordova-McCarthy**
- **Valdez-Chitna-Whittier**
- **Matanuska-Susitna**
- **Anchorage (including Anchorage SMSA)**
- **Seward**
- **Kenai-Cook Inlet**
- **Kodiak**

More complete delineation of certain deviations are noted within the discussions of each region.

This Macro-Region consists of a basin formed by the arc of the Alaska Range **which**, in effect, bounds the area on the north, east and west. The southern boundary is the Gulf of **Alaska**. It covers 83,000 square miles and subsumes the Kodiak, Lower Cook **Inlet**, and Northern **Gulf** of Alaska lease sale basins. It contains the largest city in the state, Anchorage, which alone accounts for approximately 40% of the state's population. Other major towns are Kodiak, **Valdez** (terminus of the **Alyeska** pipeline), Homer, Seward, and Cordova. The estimated 1975 population of the **Macro-Region** was **229,500**. Three different cultural groups of Native Alaskans

settled in the area--the **Tanaina** Indians in Cook Inlet, the **Chugach** Eskimos around Prince William Sound and the Eyak on the coastal strip east **of** Prince William Sound. The Gulf of Alaska Macro-Region is characterized by the highest **level** of economic development in the state. The Anchorage area serves as the service and transportation hub for all of Alaska. The fisheries industry is also very important, especially in parts of Cook Inlet, in Kodiak, and in Prince William Sound. Petroleum development is a major provider of jobs on the **Kenai** Peninsula and in **Valdez**.

Rivers provide the principal source of potable **water** in many areas and are major transportation routes in much of the roadless areas of the state. In addition, much of the economic and cultural life of Native communities depends on fish taken from rivers. The Gulf of Alaska Macro-Region watershed formed by the southern **slopes** of the Alaska Range drains an area of approximately 84,000 square miles. Its three major systems are the Copper River-Gulf of Alaska system (35,000 square miles, including 1,000 square miles in the Canadian portion of *the* system), the Cook Inlet System (38,000 square miles), and the Kodiak-Shelikof System (11,000 square miles). The **Kenai-Chugach** Range and the **Talkeetna** Range to the north decisively separate the first two drainage areas. The mouth of the Cook Inlet at Kamishak Bay serves to separate the Alaska Peninsula portion of the Kodiak-Shelikof region from **drainage** in the Cook Inlet region.

Several other significant indicators can be used to describe the character

of the Gulf of Alaska Macro-Region. Among these are the following indicators and descriptions:

- Geology and Minerals. The forces which have caused the geologic conditions in Alaska account not only for topographic change and surface drainage, but soil types and fertility, mineral resources and climate. All these factors in turn are critically related to human use for agriculture, resource extraction, construction suitability, and transportation development.

The presence and disposition of minerals in various regions of Alaska is determined by geology, since there is broad correspondence between the geologic land forms and the occurrence of minerals. For example, **hardrock** minerals such as copper and gold, and building materials such as limestone and granite are generally found in mountainous areas of the state. **Gold** and other mineral occurrence has been an impetus in the past for exploration and settlement of Alaska.

The energy fuels of coal and oil have highest occurrence and probable highest value in alluvial and coastal plains and offshore waters. Like gold, oil and other potential energy resources are providing a **similar** economic impetus today.

The Cook Inlet-Kodiak area contains significant coal and potential geothermal energy resources. Present information indicates

that at least **three** billion short tons of coal lie in the alluvial and coastal plains of the Cook Inlet area. The **Gulf** of Alaska area contains localized copper, gold, **coal** and geothermal resources.

Potentially large coal deposits exist in the Bering River coal field east of the mouth of the Copper River, but are difficult to estimate because of the convoluted structure of the beds. Significant sand and gravel resources are found in major streams and rivers of the Macro-Region. Where water courses are limited, as in the coastal areas of Prince **William Sound**, deposits of sand and **gravel** are limited.

- Ocean Currents. Ocean currents follow broad regional patterns related to **climate**, season, coastal **geogrpahy** and global ocean patterns. These currents affect distribution of nutrients and salinity along coastal areas of Arctic and **Southcentral** Alaska, and will be of critical significance in assessing the impacts of OCS petroleum development. Ocean currents are also meaningful in the identification of regions from the standpoint of the diffusion of impacts, such as **oil spills**, beyond the petroleum development area.

The primary current in the Gulf of Alaska is the westerly Alaska current. This varies in speed from .5 to 1.5 knots, but increases to 1.0 to 2.0 knots as it passes Kodiak Island and becomes the

Alaska Stream. In spring and **summer**, sediment, nutrients and fresh water enter the inshore areas, while more oceanic conditions exist in the winter.

Cook Inlet has a counter-clockwise current, and this, along with extreme tidal action, rapidly distributes glacial sediment beyond Kodiak Island; Copper River sediment is carried beyond Prince William Sound and the continental shelf by the turbulent waters.

- Elevation. **Elevational** change in **Alaska** is more extreme than in any other state, and mountain ranges demarcate more clearly than any other characteristic the state's natural and cultural regions. Variations in elevation associated with geologic formation are clearly related to ecological and human use differences. For example, approximately 98% of the state's population lives in the sea level to 1,000-foot zone, the area most productive in plant, animal, and mineral resources.

The Gulf of Alaska Macro-Region can be considered as basically one topographic region "defined by the **Alaska** Range on the north. Variations in elevation occur, however, such as the area defined by the Kenai-Chugach Range around the Prince William Sound.

Other variations include areas of less than **1,000-foot** elevation in the Matanuska-Susitna Valleys, the **Kenai** Peninsula, and the Copper River Valley. Most of the East Coast of the Alaska **Peninsula** from Tuxedni Bay to the Aleutians, and the southern **Kenai**

Peninsula extending east into Prince William Sound to Cordova rises very steeply, with **little** land less than a thousand feet in elevation. The mountain-crowded coastline limits the area for large-scale development.

- Climate. There are four basic climatic zones in Alaska: Arctic, **Continental**, Transition and Maritime. The relatively **mild Maritime** climate presents fewer limitations to the growth of natural and human communities than does the Arctic climate. Severity of climate does not prevent human activities in these regions, but special accommodations for human needs of shelter, food, water supply, and transportation are often required. The Gulf of **Alaska** Macro-Region includes two climatic zones, the Transitional and Maritime zones, with the **Kenai-Chugach** Range dividing the two regimes. The Maritime zone extends into Cook Inlet along the **Kenai** Peninsula roughly to the Turnagain Arm. The Transitional zone extending up into the **Susitna** Valley represents temperature and precipitation conditions between those of the Maritime zone and the interior Continental zone.

The most dramatic difference between these two zones is the amount of **local** precipitation. The coastal town of Whittier on Prince William Sound receives over 175 inches **of** precipitation, including 260 inches of snow, a year; whereas on the other side of the **Kenai-Chugach** Range in the Transitional zone, Anchorage receives only 15 inches of precipitation, including 66 inches of snow.

Mean temperatures in the Maritime zone reach between 55 and 60 degrees in the **summer** and between 20 and 25 degrees in the winter. Temperatures in the Upper Cook Inlet Transition zone **resemble** those of the **Gulf** of Alaska coast, but have winter mean temperatures 10-20 degrees less and summer mean temperatures approximately 10 degrees more.

- Vegetative Ecosystems. Vegetative ecosystems are the natural interactions of plants and their environment in a **particular** place and time. Vegetation in the various Alaska regions is a function of climatic differences, **physiography** and **elevation**. Thus, vegetation areas correlate closely with geographic areas defined by these physical factors. Vegetative resources have economic significance as, **for** example, wildlife habitats that support subsistence economies, or as softwood forests harvested commercially. Similarly, floral-algal **marine** vegetation supports marine mammals, fish and shellfish **vital** to both village subsistence and commercial economies.

The vegetative **ecosystem** of the Gulf of Alaska Macro-Region is divided into **two** areas: the coastal mixed spruce-hemlock areas that are commercially harvested, **and** upland areas ranging from inland valleys of mixed hardwood-softwood vegetation to alpine tundra above 2,000 feet. The coastal area represents **an** area of economic importance most likely to be impacted by OCS development.

Other aspects of vegetation in the Gulf of Alaska Macro-Region have broad correspondence with climatic regimes. The wet coastal maritime climate produces the rich **commercial** forests of coastal western hemlock and Sitka spruce. The inland valleys of the **Susitna**, Matanuska and Copper Rivers produce forests of spruce mixed with hardwoods, and softwood poplars and cottonwoods adjacent to the rivers.

Uplands are characterized by mixed spruce and hardwoods, and above the approximately 2,000-foot timberline, moist and alpine tundra and glaciers. (Wet tundra is found in the Upper Cook **Inlet** in a band ten to fifteen miles wide on either side of the mouth of the **Susitna** River.) High brush exists at **low** elevations, in the form of coastal alder thickets and willows and at higher elevations as dense alder and birch.

- Selected Wildlife Habitats. Wildlife in Alaska **plays** an **important** part in the lives of its residents. Numerous wildlife species populate every part of the state, providing a heritage that **only** previous generations of Americans have known. Fish and wildlife provide valuable sources of intake food and skins for clothing. Residents and tourists seeking hunting or wildlife observation opportunities provide substantial revenues to local economies.

The geologic regions of the state which have produced variations

in topography, surface drainage, climate and vegetation have in turn produced conditions under which different wildlife survive, and coexist. Thus, some geographic differences coincide clearly with wildlife habitats; the conditions under which they survive, and the value they may have for man in various areas must be established. Some wildlife are so wide-ranging (**although** information on their number and habitats is incomplete) as to make some regional distinctions questionable.

The coastal zone of the **Gulf of Alaska** Macro-Region is an **intensive** use area for birds and marine life. More than 100 major seabird colonies exist along this Gulf coast. Important commercial fishing of **salmon** and **halibut** takes place in the Prince William Sound, off Kodiak Island, **and** in the Cook **Inlet**. Coastal **and** intertidal crab and scallop and central and outer-continental **shelf** shrimp are also taken. The coastal zone is also an intensive use area for seal, sea otter, whales and concentrations of bald eagles, particularly at the mouths of **salmon** spawning streams. Sitka deer and bear concentrate on Kodiak Island and around Prince William Sound.

Inland, many thousands of species of terrestrial animals exist in profusion. Rural populations depend on moose for much of the red meat in their diets. Controlled commercial trapping of fur-bearing animals also takes place. Given the coastal proximity to the OCS lease sale area **in** the Gulf of Alaska, and the Coastal

Ranges which define that zone **so decisively**, the inland area wildlife may be less impacted by OCS development than will coastal wildlife. However, the disruption of a coastal habitat, particularly to waterfowl, **could** affect inland habitats because of migration routes.

- Settlement and Surface Transportation. Settlement in Alaska has proceeded from prehistoric **settlements** by diverse native groups to the industrial economies of the present day. Transportation networks have evolved to respond to the requirements of resource economies based on gold, copper and oil, and the requirements of military facilities. Existing communities have been linked--and new ones created--by the building of inland highways and the Alaska Railroad. Although transportation has tended to minimize the significance of regional boundaries, settlements and groups of settlements exist by virtue of similar economies and **commonly-held** cultural patterns. Many of these patterns follow natural boundaries.

The Gulf of Alaska Macro-Region can be divided *into* economic and cultural areas or settlements with **common** characteristics. These divisions correspond with the principal **physiographic** boundaries. Since Anchorage is the regional center of the Gulf of Alaska Macro-Region, nearby towns have economies which are largely dependent on the services which Anchorage provides. However, the **Kenai** Peninsula is an economic region dependent less on Anchorage

and more upon petroleum development centered in **Kenai** and in fishing in coastal towns. The principal towns of the Prince William Sound--**Valdez**, Seward and **Cordova--are** all historic ports serving the inland economies.

The towns and **villages** of Kodiak Island and **the** nearby section of the **Alaska** Peninsula to the west, have **common** cultural and **economic** affinities. They depend on water transportation and on the sea for their livelihood. Native cultures derive from **common** Eskimo roots.

- Land Status. Land status in Alaska includes land in fixed federal, state and private ownership, as **well** as lands which are undergoing changes within each of these ownership categories. These changes include transfers (selections and patents) from federal to state and Native ownership. They also include **changes in "status" within** federal ownership, such as designations of lands of national interest (so-called D-2 lands).

The federal and state governments and their separate agencies, and Native villages and corporations have **broad** discretionary power over the use of their land. They are also data gathering units for the lands over which they have control. Thus, it is useful to have correspondence between regions on the basis of natural factors and the areas within them controlled by the three decision-making units. Land status boundaries have generally

been adapted to basic hydrologic boundaries of various areas of the state. In other cases, as for example when lands of federal, state or Native corporations extend across mountain ranges, the delineation of the boundary is more arbitrary. In such cases, as between the Cook Inlet and the Copper River Valley in the Gulf of Alaska Macro-Region, the boundary of Native corporations has been followed, since they often follow hydrologic boundaries.

The Gulf of Alaska Macro-Region is characterized by the complex land patterns representing the most populous region in the state. There are thirty-three native village withdrawals for eligible villages. Large federal encumbrances include the Katmai National Park and lands on Kodiak Island in the Kodiak-Shelikof area; the proposed Mt. McKinley National Park addition and the Kenai National Moose Range in the Cook Inlet area; and the Chugach National Forest, the Wrangell Mountain National Forest and the proposed Wrangell-St. Elias National Park in the Gulf of Alaska area.

NORTH GULF OF ALASKA REGION

The North Gulf of Alaska lease-sale area, as shown in Figure 4, extends from the narrow, northernmost section of the Alaska "panhandle" northwest along the coast to Prince William Sound. The North Gulf of Alaska regional boundary follows the Chugach Native corporation (Chugach Natives, Inc.) boundary (including English Bay and Port Graham) and includes a small portion of Sealaska Corporation, contiguous with the lease-sale area from Chatham Strait north to the Chugach boundary (following the Skagway-Yakutat census division boundary). This area includes the borough of Haines and a small portion of the Kenai Peninsula borough. It covers the entire census divisions of Skagway-Yakutat and Haines and major portions of Cordova-McCarthy, Seward and Valdez-Chitina-Whittier census divisions. The labor market areas prior to the 1978 shift to census divisions include Seward, Valdez-Chitina-Whittier, Cordova-McCarthy, and Lynn Canal-Icy Straits.

The potential onshore impact area extends along the coastal basin parallel to the lease-sale area boundaries. The region is bounded by the Chugach mountains to the north, the St. Elias mountains to the east, and the Kenai mountains to the west. Originally inhabited by Eyak Indians, Unukuguit and Chugach Eskimos, the region is sparsely settled, with the only major population centers at Valdez, Cordova, and Seward. Valdez, a home rule city, is the southern terminus of the Alyeska pipeline and has grown rapidly with the demands of pipeline port and storage facility construction. Cordova is also a home rule city, with a population of 1,164

(1970). It was the proposed supply base for the terminus and LNG facility of the now defunct El Paso natural gas pipeline.

The Prince William Sound and the Seward areas may be considered networks of interacting communities due to the **common** demands of the commercial fishing season which draws residents of outlying areas to work in the fishing fleets and canneries during the runs. The present economic base for the region is fisheries and timber, although transportation of petroleum from **Valdez** will grow in importance. The region includes much of the **Chugach** National Forest, an important timber reserve.

Regional components are displayed in Table 3. Existing data are insufficient at this writing to determine subregional boundaries in this Petroleum Development Region.

TABLE 3

REGIONAL COMPONENTS
NORTH GULF OF ALASKA PETROLEUM DEVELOPMENT REGIONS

<u>Labor Market Areas (prior to 1975)</u>	<u>Census Divisions</u>	<u>Regional Corporations</u>	<u>Boroughs and Municipalities</u>	<u>Communities</u>	
Seward*	Seward*	Sealaska*	Haines Borough	Boswell Bay	Point Whitshed
Valdez-Chitina-Whittier*	Valdez-Chitina-Whittier*	Chugach	Kenai Peninsula Borough	Cape Yakataga	Port Ashton
Cordova-McCarthy*	Cordova-McCarthy*			Chenega	Port Graham
Lynn Canal-Icy Straits	Skagway-Yakutat-Haines			Cordova	Seward
				English Bay	Tatiklek
				Eyak	Thompson Pass
				Katalla	Valdez
				Meakerville	Whittier
				Middleton Island	Yakutat
				Ocean Cape	

36

*Indicates the inclusion of portions of data collection areas.

LOWER COOK INLET REGION

The Lower Cook Inlet lease-sale area, shown on Figure 4, is located in the mouth of Cook Inlet, extending north to **Kalgin** Island. The Lower Cook Inlet region **encompasses** both shores of Cook Inlet. The boundary follows that of Cook Inlet Region, Inc., but excludes the **Matanuska-Susitna** Borough, and includes English Bay and Port Graham. It is bounded by the **Kenai** Mountains to the east, the **Matanuska-Susitna** Borough boundary to the North, and the **Chigmit** Mountains to the west. Containing the Municipality of Anchorage, this area is the most densely populated in the state.

Cook Inlet is the traditional home of the **Tanaina** Indians. The present population consists of a cultural mix of Indians and whites who have migrated to Alaska from the lower 48 states. The population is **overwhelmingly** white with Natives comprising less than 5% of the 1970 population.

The economy of the Cook **Inlet** region varies tremendously. Anchorage is the economic center of the state, and includes major components of state government, as well as industrial and corporate activities. The Cook Inlet area south of Anchorage has experienced considerable development since the 1950's, when oil and natural gas began to be extracted from fields in the upper Cook Inlet and **Kenai** Peninsula. The oil-and-gas related economic boom enjoyed by the area is largely confined to the western coast of the **Kenai** Peninsula on the east side of Cook Inlet,

while the western slopes of Cook Inlet (Alaska Peninsula) remain relatively unaffected. With the exception of the Alaskan Peninsula area, the entire Cook Inlet region has developed the most sophisticated communication and transportation network in the state.

Regional components are displayed in the Table 4. Existing data are insufficient at this writing to determine subregional boundaries in this Petroleum Development Region.

TABLE 4

REGIONAL COMPONENTS
 LOWER COOK INLET PETROLEUM DEVELOPMENT REGION

<u>Labor Market Areas prior to 1975)</u>	<u>Census Divisions</u>	<u>Regional Corporations</u>	<u>Boroughs and Municipalities</u>	<u>Communities</u>
Kenai-Cook Inlet	Kenai-Cook Inlet	Cook Inlet Region, Inc. *	Municipality of Anchorage	Anchor Point and Nikolaevsk Hope
Anchorage	Anchorage		Kenai Penin- sula Borough	Anchorage Bay City Beluga Lake Birchwood Campbell Chenik Chugiak Clam Gulch Cohoe Cooper Landing Eagle River Eklutna Elmendorf AFB English Bay" Fire Island Fire Lake Fort Richardson Fritz Creek Girdwood Glen Alps Halibut Cove Homer
				Jakolof Bay Kachemak Kalifonski Kamishak Kaslof Kenai Moose Pass Nikiska Ninilichik Point Possession Port Graham Port Nikiski Portage Portlock Salamatoff Seldovia Soldotna Sterling Sunrise Tyonek Wildwood

*Indicates the inclusion of portions of data collection areas.

KODIAK REGION

The Kodiak lease-sale area, shown in Figure 4, lies southeast off Kodiak Island. The Kodiak petroleum development region encompasses **Koniag**, Inc. and the Kodiak Island Borough, a second-class borough, which includes five second-class cities (Ahkiok, Larsen Bay, Old Harbor, **Ouzinkie**, and Port Lions) and one home rule city and borough seat (Kodiak). The City of Kodiak is the only major settlement within the Koniag region and has a Manager Council form of government. As of 1970, the Kodiak Borough had an estimated population of 9,493. Kodiak, Kodiak Coast Guard Station, and Port O'Brien are the only non-Native communities within the region. The area is settled by members of two **eskimo** groups, the **Koniag Eskimos** of Kodiak Island and the Peninsular Eskimos of the Alaska Peninsula.

Development in the region is limited by lack of transportation. The City of Kodiak is linked by road to its surrounding area, and by ferry to the mainland. Most villages, however, are accessible only by air or small boats, and those on the Alaska Peninsula are particularly isolated. The City of Kodiak is an essential conduit for the movement of goods and services to the villages in this region. Fishing and fish processing form the economic base for the area with additional major economic activity in timber and cattle grazing. Fish and shellfish processing plants are concentrated in Kodiak harbor due to the reliable communication and transportation facilities in the **community**, although plants are scattered at other sites such as Jap Bay on the south end of Kodiak Island. The

Afognak Native Village Corporation **plans to** build timber dock facilities, and a logging permit has been applied for by **Southcentral** Timber Corporation for a portion of **Afognak** Island.

The Kodiak Petroleum Development Region in addition to all of the Kodiak, Inc. , areas (Kodiak Island, Afognak Island, and a small portion of the **Alaska Peninsula**), also includes portions of the **Alaska** Peninsula in the Aleut Native Claims Region and in the **Bristol** Bay Native Claims Region. The **community** of Seward is also included due to its importance as a nearby port.

The boundary line follows that of the Kodiak region on the peninsula, and includes the Aleutian census enumeration districts **14** and **27**.

Regional **components** are displayed in Table 5. Existing data are insufficient at this writing to determine subregional boundaries in this Petroleum Development Region.

TABLE 5
REGIONAL COMPONENTS
KODIAK PETROLEUM DEVELOPMENT REGION

<u>Labor Market Areas (prior to 1975)</u>	<u>Census Divisions</u>	<u>Regional Corporations</u>	<u>Boroughs and Municipalities</u>	<u>Communities</u>	
Al euti an*	Al euti an*	Koniag	Kodi ak Isl and	Afgonak Ahki ok Aiaktalik Anton Larsen Bay Ayakulik Belkofski Bells Flats Cape Sarichef AFB Chiniak Cold Bay False Pass Ikatan Kaguyak Karluk King Cove Kitoi Bay Kodi ak Kodi ak Coast Guard Station Larsen Bay Litnik	Nel son Lago on Old Harbor Ouzinkie Pavlof Harbor Port Li ons Port O' Bri en Port Wi lli ams Sanak Isl and Sand Poi nt Seward Shuya k Squaw Harbor Strel na Uganik Unga Unimak Uya k Woody Isl and
Bri stol Bay*	Bri stol Bay*	Al eu t			
Kodi ak	Kodi ak	Chugach			
Seward	Seward	Bri stol Bay			

*I ndi cates the i ncl usi on of por ti ons of data-col lecti on areas.

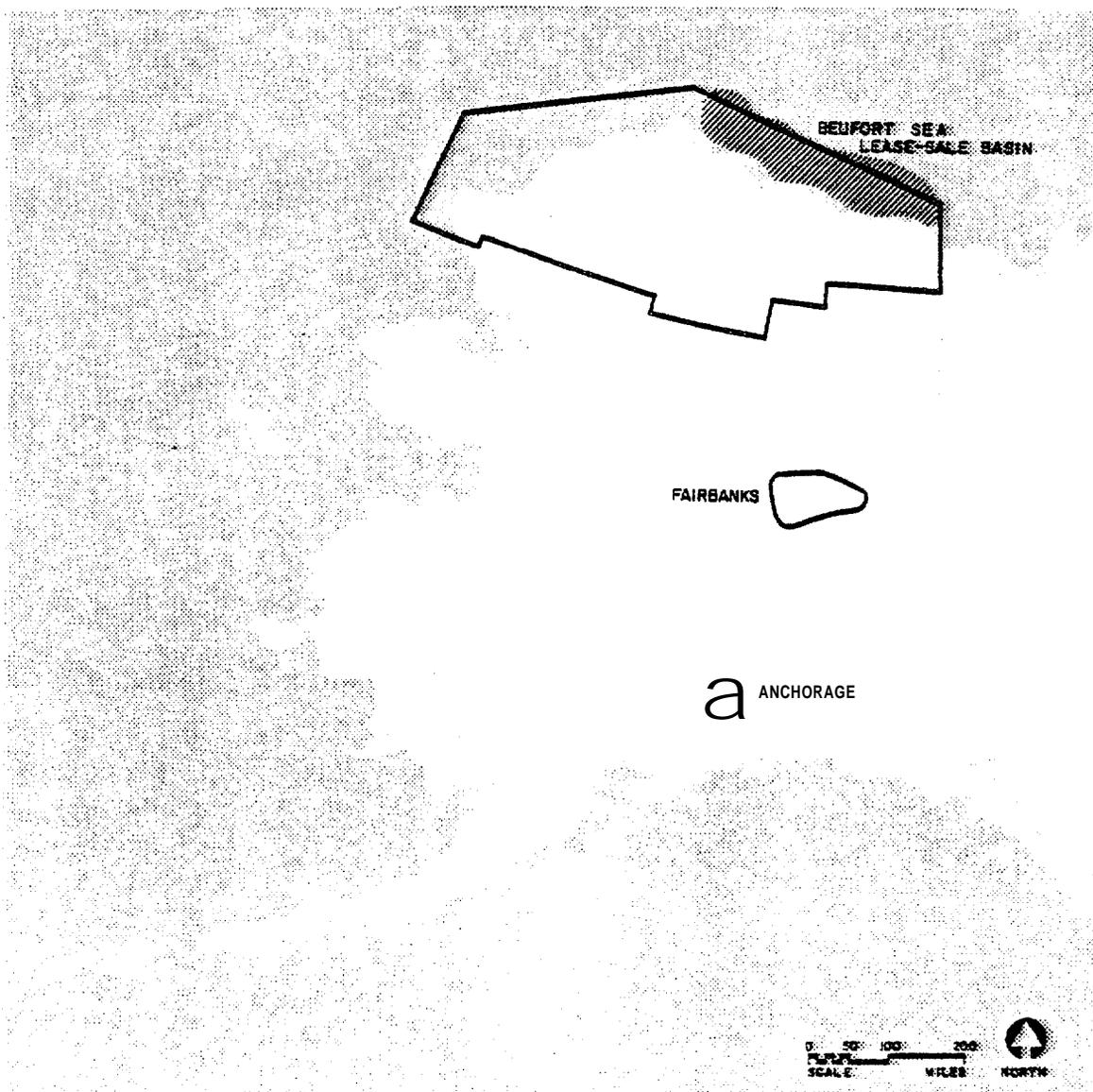
Beaufort Sea Region

The Beaufort Sea lease-sale basin and related Petroleum Development Region, including the associated impact areas discussed earlier, is shown in Figure 5. The basin lies offshore north of the Arctic coast from Point Barrow east to the Canadian border. The Beaufort Sea Petroleum Development Region is bounded on the north by the Arctic Ocean, on the east by the Canadian border, on the south by the Brooks Range and on the west by the **Chukchi** Sea. Its boundaries encompass an area of 81,000 square miles. The major community and service center in the region is Barrow. According to 1976 Alaska population estimates, approximately 12,600 people live in the Beaufort Sea region, the traditional home of the **Inupiat** Eskimos; of this number, 3,600 were **Inupiat** Eskimos and a **small** number of whites **living** in traditional **communities**, 8,800 were petroleum development and pipeline employees living in work camps, and 200 were military personnel living on military stations. With the discovery and development of petroleum at Prudhoe Bay, the economic base of the area is becoming increasingly involved with oil and gas exploration and development--not only at **Prudhoe** Bay, but also in the National Petroleum Reserve-Alaska (**NPR-A**) and potentially offshore in the Beaufort Sea.

Several significant factors can be used to describe the character of the Beaufort Sea Petroleum Development Region. These factors and their description are:

- Hydrology. Most of the significant streams and rivers in the

FIGURE 5



BEAUFORT SEA PETROLEUM DEVELOPMENT REGION
AND ASSOCIATED IMPACT AREAS

Beaufort Sea region occur in its eastern portion, where precipitation is greater than in the west. The most important river in the Arctic is the Colville River, which empties into the Beaufort Sea near the village of Nuiqsuit, approximately 30 miles west of Prudhoe Bay. The Colville River has a vast inland watershed draining about 24,000 square miles and its tributaries extend west along the foothills of the Brooks Range. Most of the drainage from the middle section of the Brooks Range eventually finds its way to the Beaufort Sea by way of the Colville, accounting for about 80% of the drainage of the region. The Colville and other smaller rivers are important fish and game habitats for Arctic subsistence and local economies.

Water flows" moderately in the summer, but stops in the winter in all rivers in the Arctic. Flooding is known or inferred for the Colville River and several other rivers in the Arctic. These conditions affect availability of potable water and siting for human settlements in this region.

- Geology and Minerals. Unconsolidated deposits in the region are found in the coastal plain and alluvial river valleys, and include gravel, sand and dunes, peat and clay. Some other unconsolidated deposits are found as glacial debris in the foothills of the Brooks Range. With the exception of the glacial deposits, these conditions are confined to the flat or irregular plains of less than 400 feet elevation. The foothills include sedimentary,

shale and sandstone and volcanic rocks. Higher elevations have limestone, sandstone, dolomite and other **granitic** intrusive rocks. In areas of permafrost, construction suitability is severely limited. Such limitations have a direct impact on patterns of regional settlement. The region contains two broad geologic areas: first, the unconsolidated deposits in the **coastal** plains, rivers, valleys, and foothills of the Brooks Range; and, second, the higher elevations containing consolidated elements and **granitic** rocks.

Oil and gas provinces correspond with major sedimentary basins. The area of high occurrence of **oil** and gas lies on the Arctic Slope of the Brooks Range up to an elevation of approximately 2,000 feet. **Deposits** are found in sandstone and limestone strata throughout the coastal plain of the Beaufort Sea with probably greater occurrence near the Arctic Ocean.

Coal exists in **large** quantities in the region in a broad expanse of coal-bearing **cretaceous** rocks, mainly sandstone and shales, covering nearly 60,000 square miles from the west to the Canning River. Principal coal beds are west of the **Itkillik** and lower **Colville** Rivers. Significant beds of coal lie in the **Colville** River basin, with bituminous **coal** outcrops along the tributaries of the river. The entire region contains broad, east-west bands of potential coal deposits and **oil** north of the Brooks Range, which can be divided into two major divisions: coastal areas and mountainous areas.

Sand and gravel, important for any construction in the Arctic, are principally found in major rivers and streams in the east. There is **only** minor occurrence of gravel beaches east of Point Barrow to the **Colville** River. Many **inland** deposits in permafrost and coastal areas severely constrain extraction, and coastal retreat or the creation of **inland** lakes could be caused by over-extraction.

- Ocean Currents. The primary current along the north **coast** of Alaska is the westerly Arctic **gyre**. This dominates the **Beaufort** Sea and tends to move water and ice shoreward. Variable, **short-term** surface currents counter this gyre at times and can result in relatively ice-free conditions during late **summer** and fall. A northerly current through the Bering Strait brings both cold Bering Sea and relatively warm Alaskan coast waters into the **Chukchi** Sea. This latter sea, divided from the Beaufort Sea at Point Barrow, is generally shallower and warmer than the eastern waters. This North Alaska littoral current is gradually deflected westerly by the Arctic gyre as it reaches Point Barrow. The velocity of these currents ranges from one **mile** per day for the Arctic gyre to **.8** to 2.4 knots at Cape Prince of **Wales** for the northerly currents.

- Elevation. The Brooks Range rises to elevations of 7,000 to 8,000 feet, dropping off steeply in the central portion of the range and less steeply towards its lower, western portion. The

foothills to the north of the range consist of rolling plateaus and low mountains. The flat coastal plain is more than 100 miles wide in the west and narrows to approximately 10 miles near the Canadian border. This coastal area is most likely to be affected by activities related to OCS development.

Three distinct elevation areas can be identified for the Beaufort Sea region: the flat coastal plain, the rolling foothills, and the 7,000-to 8,000-foot Brooks Range.

- o Climate. The Arctic Zone corresponds with the Beaufort Sea region as defined by the crest of the 600-mile-long Brooks Range with cold average temperatures and persistently strong winds across the northern half of the area.

Precipitation levels do not increase in the vicinity of the coast in the Arctic, as they do so dramatically in the Gulf of Alaska coastal area. Because precipitation levels are low, the region is classified as a kind of "Arctic desert." Precipitation increases from west to east and towards the higher elevations of the Brooks Range. The mean annual snowfall ranges from twenty inches at Barrow to 100 inches in the highest parts of the Brooks Range. This represents practically all the total annual precipitation, since there is little rain.

- Vegetative Ecosystems. The three vegetative areas of the Beaufort Sea region correspond generally to three physiographic

regimes in the region: the wet tundra of the coastal plains, the moist tundra of the Arctic foothills, and the alpine tundra of the Brooks Range.

Tundra refers to the Vegetation of rolling grassland found in Arctic areas of the world. Wet tundra in the Arctic includes areas of grasses, lichens, mosses, herbs and shrubs interspersed with small lakes and ponds, and is an important bird nesting habitat. Wet tundra is difficult to negotiate and, hence, presents limitations to the construction of roads and other development.

- Selected Wildlife Habitats. Despite limited vegetation and forbidding climate, significant populations of caribou, wolves, moose, dall sheep, foxes and musk oxen inhabit the region. Rivers in the east are an important habitat for moose and grizzly bear. There are two major caribou herds, the Arctic in the west and the Procupine in the east. Bear and moose are found along major streams and high brush of the east Arctic foothills. Other conditions generally indicate a richer wildlife habitat in the west Arctic than in the east. More than half the waterfowl in the Arctic are west of the Colville River residing in the ponds and lagoons of the wet tundra.

Other wildlife habitats range across the region, establishing an especially important coastal zone. These habitats generally correspond to topographic elevational zones. Waterfowl and

polar bear inhabit the wet coastal zone. Caribou and their predator, wolves, are drawn to the moist tundra. Dan sheep are found in the mountain zones. Coastal areas are migration routes for seals, whales and walrus. Subsistence fishing occurs in all coastal settlements.

- Settlement Pattern. Until very recently, settlement in the region was based on prehistoric subsistence patterns. Petroleum development around Prudhoe Bay has tended to create two populations, one predominantly Native and living in traditional permanent communities and the other predominantly non-Native and living in industrial work camps.

- o Land Status. Some state, federal and Native land boundaries cross over the hydrologic boundary defined by the crest of the Brooks Range, making regional definition on the basis of land status somewhat arbitrary. Alternatively, the boundary of the Arctic Slope Regional Corporation corresponds more closely the basic hydrologic boundary. The largest single unit of land in the Arctic is National Petroleum Reserve-Alaska (NPR-A) which extends west **from** the Colville River **to** Icy Cape. With the exception of tentatively selected state lands near Point Lay and Point Hope, the western balance of the region is in either a Native village or regional withdrawal area.

Land status in the east is somewhat more complex than in the

west. Significant withdrawals include the Arctic National Wildlife Range, the state selections patented in the vicinity of Prudhoe Bay, and the utility corridors of the oil pipeline and the possible gas pipeline. Smaller federal withdrawals for classification in public interest (D-1) and withdrawals for possible inclusion in the Four National Systems (D-2) exist in the foothills and mountains of the region.

The area to the east of the Colville River, the traditional home of Nunamuit and Taremuit Eskimos, is very sparsely settled, Kaktovik (on Barter Island) and Anaktuvuk Pass (near the Brooks Range) are the only incorporated areas. Both are second-class cities and Native villages. The population of this eastern area is concentrated at Kaktovik, Deadhorse/Prudhoe Bay and Anaktuvuk Pass. The economy of this eastern area is based on traditional subsistence activities of hunting and fishing and the recent petroleum development activities associated with the trans-Alaska oil pipeline. There is also a DEW-line station on Barter Island near Kaktovik. The far eastern edge of the region is set aside as the Arctic National Wildlife Range.

The area to the west of the Colville River includes National Petroleum Reserve-Alaska (NPR-A), a first-class city--Barrow, two second-class cities--Wainwright and Point Hope, and the communities of Atkasook, Cape Lisburne, Nuiqsuit, Point Lay, and Umiat. Nuiqsuit is a new native village of about 150 people located at a traditional village site about twenty miles upstream from the mouth of the Colville River. The economy

of this western area is, almost exclusively, based upon subsistence hunting and fishing together with government employment. There are military installations at Cape Lisburne, Point Hope (national guard armory), Point Lay and Wainwright. Nuiqsuit has a small commercial fishery (summer only). As petroleum exploration increases in NPR-A, Wainwright in particular may become a support area, significantly altering its economic base. Gas fields have been located near Umiat and high-grade coal deposits exist at Cape Lisburne, Point Lay, and Wainwright. While mineral exploration will continue, there are no plans for commercial mining at this time.

ASSOCIATED IMPACT AREAS

For the Beaufort Sea Petroleum Development Region, two "associated impact" areas have been identified for socioeconomic impact assessment purposes. They are:

- The Municipality of Anchorage
- The Fairbanks-North Star Borough

These two associated impact areas will be analyzed during both baseline data collection and impact assessment activities. They have been identified because of their importance as major population and economic supply and market areas of the state and because they are likely to be significantly affected by any OCS development in the Beaufort Sea.

Anchorage and Fairbanks are Alaska's largest cities. Together they

contain **within** their metropolitan areas approximately 58% of the state's population as of 1975.

Anchorage

*

Anchorage dominates the state's economy as a service, government, and transportation center for all economic activities in the state. Most of the major petroleum companies and supply companies have their headquarters in Anchorage. Much of the hiring of personnel and supplying of equipment is based in the Anchorage area.

Anchorage had estimated population of 125,542 within the city limits in 1970. Additionally, Anchorage is adjoined by two major military bases-- Elmendorf Air Force Base (population 6,019 in 1970) and Fort Richardson (population 8,960 in 1970). The Municipality of Anchorage includes Anchorage suburbs and a dozen **communities** of which only Girdwood is incorporated as a first-class city and Glen Alps as a second-class city.

The development of Anchorage as an economic center for the state was triggered by the building of the Alaska Railroad. Transportation **is** still a key factor in the city's importance, and Anchorage is linked to other parts of the state, the lower U.S., and foreign ports through air, rail, highway and port facilities. As Anchorage has grown, it has attracted most of the state's industrial and corporate activities. Organizations doing business elsewhere in the state frequently maintain Anchorage headquarters, including petroleum-related corporations; state government

offices, timber, fishing, and shipping companies; Native regional **cor-**
porations; and many others. Any economic activity in the state will have
some effect on Anchorage as the major in-state source of services
materials and professional expertise.

Fairbanks

Fairbanks is the northern terminus of the Alaska railroad and the point
of departure for most of the petroleum activity on the North Slope. It
is also the location of the main campus of the University of Alaska. Much
of the impact caused by the construction of the **trans-Alaska** pipeline
centered in Fairbanks. Major supply yards and training facilities were
established in and around the Fairbanks area and **it** bore a major brunt
of the impact of the **oil** pipeline.

Both Anchorage and Fairbanks will play an integral part in any expansion
of the state's economy in the North Slope area. Services, personnel, and
equipment will be drawn from and passed through one or both communities.
Both will be impacted by immigrants working on the North Slope or in **off-**
shore facilities. These individuals may seek permanent living quarters
in the major metropolitan areas of the state and thus center their **lives**
and service needs in Fairbanks *or* Anchorage. Both **communities** are **likely**
to be affected by companies that purchase their petroleum equipment or
materials within the state. They may also be affected as likely rest and
recreation areas in which employees may spend **income** earned at isolated
petroleum camps.

The variety of goods and services necessary for continued economic expansion of the North Slope can be purchased in or transshipped through Fairbanks and Anchorage. They have the widest range of services and the flexibility necessary to respond to the market demands of OCS petroleum development.

In addition to Anchorage and Fairbanks --which will be associated impact areas regardless of the precise location of OCS facilities in the Beaufort Sea region--other associated impact areas will likely be defined. As petroleum development scenarios are generated for the Beaufort Sea lease-sale area, the potential location of onshore facilities and pipelines or other modes of transporting petroleum from the Arctic Slope to markets in the lower 48 states will be determined. Since the range of potential scenarios is wide, the list of "potential" associated impact areas is similarly diverse. When the alternatives are incorporated in the petroleum development scenarios, the appropriate communities will be identified as associated impact areas.

Regional components are displayed in Table 6. Existing data are insufficient at this writing to determine subregional boundaries in the Petroleum Development Region.

TABLE 6

REGIONAL COMPONENTS
BEAUFORT SEA PETROLEUM DEVELOPMENT REGION

<u>Labor Market Areas prior to 1975)</u>	<u>Census Divisions</u>	<u>Native Corporations</u>	<u>Boroughs and Municipalities</u>	<u>Communities</u>	
Upper Yukon*	Upper	Arctic Slope Regional Corporation	North Slope Borough	Anaktuvuk Pass	Nuiqsut
Upper Yukon*	Upper Yukon*			Atkasook	Point Hope
Barrow	Barrow			Barrow	Point Lay
				Bri tpet	Prudhoe Bay
				Cape Lisburne	Sa gwon
				Deadhorse	Umiat
				Kaktovik	Wainwright

56

*Indicates the inclusion of portions of data collection areas.

Bering-Norton Region

The proposed Bering-Norton Basin lease-sale area, shown in Figure 6, is located immediately south of the Bering Strait, bounded on the west by St. Lawrence Island, and extending eastward into Norton Sound.

The related Petroleum Development Region, also illustrated in Figure 6, includes all of the Bering Straits Native Corporation, which is the coastal land of the southern Seward Peninsula and the Alaskan coast from Cape **Denbigh** in the Norton Sound to Stuart Island. In addition, the region includes all of the Wade Hampton and Bethel census divisions.

Topographically, this region includes three hydrologic areas: the portion of the Seward Peninsula that empties into Norton Sound; the lower Yukon and Yukon Delta; and the lower Kuskokwim River.

Population is evenly distributed among the three hydrologic areas, and along the **coast** between the Yukon **Delta** and **Kuskokwim** Bay. As of 1970, the region, as defined, contained approximately 14,000 persons.

In the Seward Peninsula hydrologic area, most of the population is distributed in coastal and inland settlements whose patterns of interaction are oriented to Nome.

In the other two hydrologic areas, settlements are located in clusters along one of the two major rivers, the Yukon and the **Kuskokwim**. According to the 1970 census, approximately **1,500 people** live in settlements

FIGURE 6



BERING-NORTON PETROLEUM DEVELOPMENT REGION

in the Yukon Delta, and an additional 1,300 live in **communities** clustered along the Yukon River in this region. The Kuskokwim River area contains approximately 4,270 persons in communities oriented towards Bethel. Because of the ethnic similarities, cultural patterns, subsistence **activities**, and labor force demands **of** economic activity, these settlements may be considered a network of interacting villages. **Bethel is** the largest community in both the Bering-Norton region and western Alaska. The **villages** inland from Bethel on both the Yukon and Kuskokwim Rivers provide Bethel with its needed seasonal labor force. Conversely, Bethel provides not only **employment** and generates cash income, it also provides **extensive** human services to the area's population

The various regional components of the Bering-Norton Petroleum **Development** Region are displayed in **Table 7**.

TABLE 7

REGIONAL COMPONENTS
 BERING-NORTON PETROLEUM DEVELOPMENT REGION

<u>Labor Market Areas prior to 1975)</u>	<u>Census Divisions</u>	<u>Regional Corporations</u>	<u>Boroughs and Municipalities</u>	<u>Communities</u>
Nome	Nome	Bering Straits		Alakanuk Mtn. Village
Wade Hampton	Wade Hampton	Calista* (north- western third)		Chakatouk Nome
Bethel	Bethel (north- western half; E.D. 24, 27, 18b, 23)			Chevak Old Andreefsky
				Council Pilot Station
				Emmonak Port Clarence
				Golovin St. Marys
				Hooper Bay St. Michael
				Kotlik Scammon Bay
				Koyuk Shaktoolik
				Marshall

*Indicates inclusion of a portion of data collection areas.

Bering-St. George Region

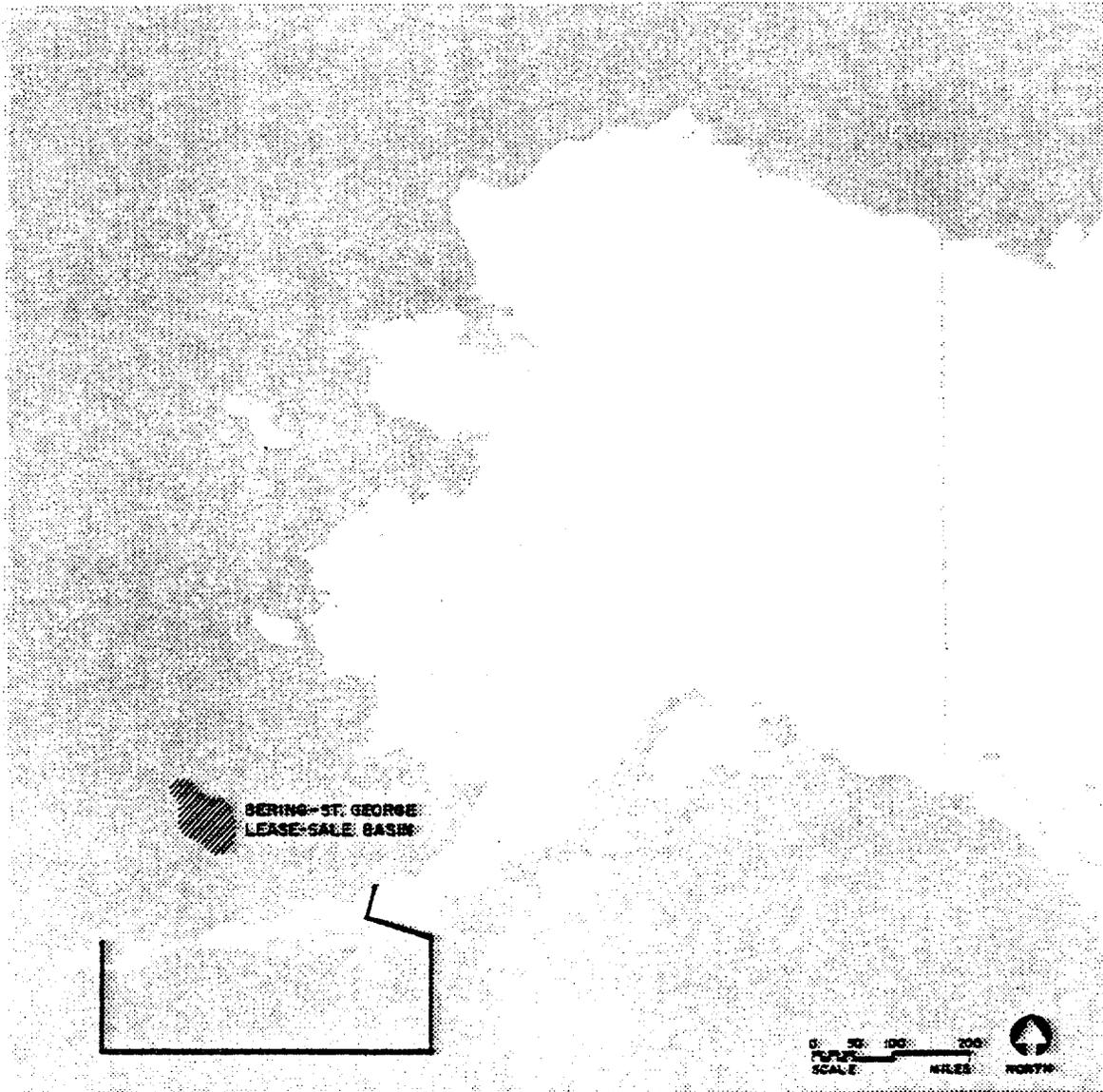
The proposed St. George lease-sale area, shown in Figure 7, is located in the Bering Sea immediately south of St. George Island of the **Pribilof** Islands, and immediately north of **Unimak** Pass, the major **trans-Aleutian** sea route. The related Petroleum Development Region; **also** shown in Figure 7, includes the **Pribilof** Islands, and that section of the Aleutian Island chain between **Unimak** Pass in the west and Nelson Lagoon in the east. The onshore region is limited only to the **Pribilofs** and this section of the Aleutian Island chain because **of** the lease-sale area's great distance from existing onshore facilities in Bristol Bay. Because the proposed lease-sale area is adjacent to **Unimak** Pass, onshore development will most likely occur in those harbors of the Aleutian **Is-**lands cited as potential ports, or in ports already being developed in the Gulf of Alaska.

Hydrologically, there is very little surface water, necessitating rain-water collection for a portion of the water supply.

The region's population as of 1970 totaled approximately 1,400, with most of them centered at military facilities scattered among the islands.

The various regional components of the Bering-St. *George* Petroleum Development Region are displayed in Table 8.

FIGURE 7



BERING-ST. GEORGE PETROLEUM DEVELOPMENT REGION

REGIONAL COMPONENTS
 BERING-ST. GEORGE PETROLEUM DEVELOPMENT REGION

<u>Labor Market Areas prior to 1975)</u>	<u>Census Divisions</u>	<u>Regional Corporations</u>	<u>Boroughs and Municipalities</u>	<u>Communities</u>
Aleutian	Aleutian Islands (E. D. 14, 27, 34, 34a, 34b only)	Aleut		Akutan Nikolski Belkofski Pavlof Harbor Chernofski Sand Point Cold Bay Squaw Harbor Dutch Harbor Umnak Fort Means Unga King Cove Unimak Nelson Lagoon

Kodiak-Aleutian Region

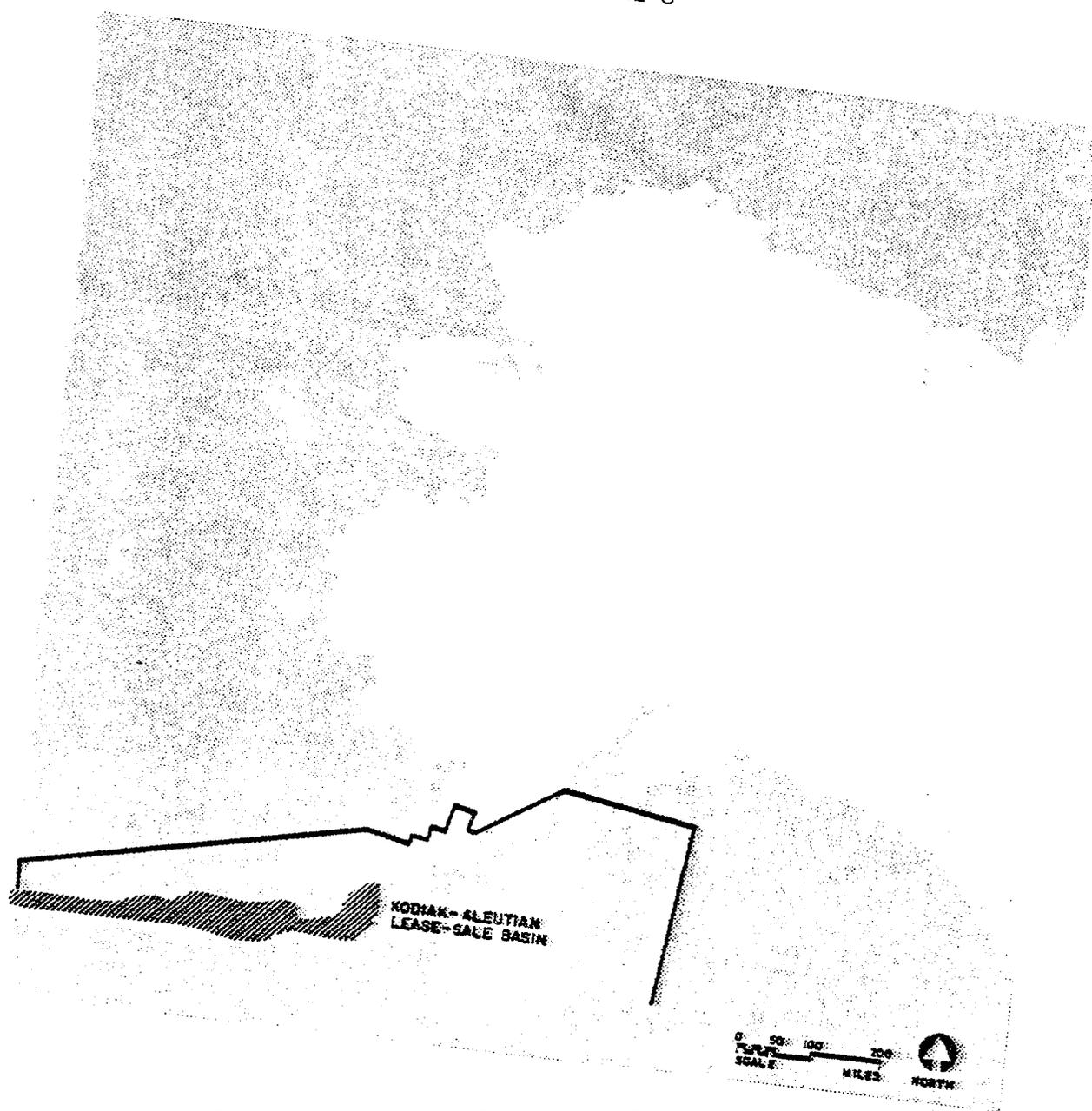
The proposed Aleutian Shelf lease-sale area, shown in Figure 8, is located immediately south of Unimak Pass, Cold Bay, and Shumagin Islands. The related Petroleum Development Region, also shown in Figure 8, includes the southern coast of the Aleutian chain and the Alaska Peninsula; Kodiak Island; and the Koniag, Inc. Native Corporation in its entirety.

The Aleutian Shelf region does not contain any substantial hydrologic sub-regions or watersheds similar to those of other western Alaskan regions. The exception is that part of the Alaska Peninsula within the boundaries of the Koniag, Inc., Native Corporation which includes Becherof Lake and its feeder streams. Most of the land further to the west is characterized by a lack of groundwater. Climatically, the Aleutian chain receives consistently bad weather because it is on the Pacific storm track. It serves to protect Bristol Bay from the extremes of this type of weather.

As of the 1970 census, the region contained 11,036 people of whom approximately 1,625 inhabited the Aleutian Island chain, and 9,409 inhabited the Kodiak Borough. Except for the City of Kodiak, the population is scattered in villages along the southern coast of the island and at various military installations.

The economy of the region is heavily dependent upon fishing and service employment at the various military installations. The military jobs have been a major determinant of the migration trends along the Aleutian

FIGURE 8



KODIAK-ALEUTIAN PETROLEUM DEVELOPMENT

REGION

chain. The only ground transportation network serves Kodiak Island. All other communities are reached only by air or water. Major aviation and port facilities exist at Cold Bay and Dutch Harbor in the Aleutians.

Kodiak Island is the most developed area in the region. The City of Kodiak is connected with Anchorage, Seward, and the rest of southcentral Alaska by the state ferry, as well as regular and frequent air service. (See discussion of Kodiak under the Gulf of Alaska Macro-Region).

The various regional components of the Kodiak-Aleutian Petroleum Development Region are identified in Table 9.

TABLE 9

REGIONAL COMPONENTS
KODIAK-ALEUTIAN PETROLEUM DEVELOPMENT REGION

<u>Labor Market Areas prior to 1975)</u>	<u>Census Divisions</u>	<u>Regional Corporations</u>	<u>Boroughs and Municipalities</u>	<u>Communities</u>
Kodiak	Bristol Bay* (E.D. 28b, 29)	Koniag, Inc.	Afgonak	Kanatak
Aleutian	Kodiak	Aleutian Native Corporation	Cape Chaitak	Karluk
	Aleutian* (E.D. to 36a)		Cold Bay	Kodiak
			Dutch Harbor	Squaw Harbor
			Fort Heiden	Unimak
			Fort O'Brien	Upper Station
			Indian Village	Uyak
			Ivanhof Bay	Woody Island
			Kaguyak	

*Indicates inclusion of portions of data collection units.

67



REFERENCES

1. U.S. Department of the Interior, Bureau of Land Management, Outer Continental Shelf Office, Washington, D.C., July 1976.
2. Selkregg, Lydia L., University of Alaska Arctic Environmental Information and Data Center. Alaska Regional Profiles, Volumes I and II (Southcentral and Arctic Regions), sponsored by State of Alaska, Office of the Governor, in cooperation with the Joint State-Federal Land Use Planning Commission for Alaska, Juneau, 1975.
3. Alaska Department of Labor, **Employment** Security Division, Research and Analysis Section. Alaska 1970 Census Atlas, Population by Enumeration Districts, Juneau, 1970.
4. Dixon, Mire, Undated Memorandum on Regional Identification.