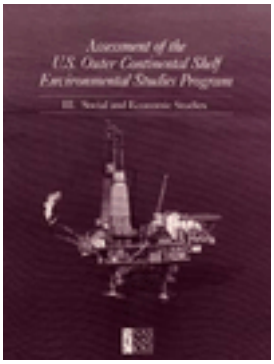

Assessment of the U.S. Outer Continental Shelf Environmental Studies Program: III. Social and Economic Studies

Socioeconomics Panel, Committee to Review the Outer Continental Shelf Environmental Studies Program, Board on Environmental Studies and Toxicology, National Research Council

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Assessment of the U.S. Outer Continental Shelf Environmental Studies Program

III. Social and Economic Studies

Socioeconomics Panel
Committee to Review the Outer Continental Shelf Environmental Studies Program
Board on Environmental Studies and Toxicology
Commission on Geosciences, Environment, and Resources

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* This study originally was undertaken under the auspices of the Commission on Physical Sciences, Mathematics, and Resources (see Appendix A).

Preface

The review leading to this report was initiated in May 1986 by the National Research Council (NRC) at the request of the Minerals Management Service (MMS) of the U.S. Department of the Interior. Under the auspices of the NRC Board on Environmental Studies and Toxicology, the Committee to Review the Outer Continental Shelf Environmental Studies Program was formed to carry out the overall assignment. Three panels were established, one of which, the Socioeconomics Panel, investigated a full spectrum of social and economic aspects of the Environmental Studies Program (ESP). This report is the third of the three panel reports; the first two dealt with physical oceanographic and ecological aspects of the same Department of the Interior program. Companion reports by this committee dealt with leasing areas offshore of Florida, California, and New England.

A great deal has happened since 1986 when the OCS committee began its work. The *Exxon Valdez* ran aground and deposited some 240,000 barrels of Alaska crude in Prince William Sound. The Soviet Union collapsed. Iraq invaded Kuwait, and the United States and United Nations joined in Operation Desert Storm. Closer to home, President George Bush in June 1990 considered the evidence, including a report from this committee, and decided not to explore several offshore areas: parts of Florida, California, and Georges Bank all were placed off limits until the year 2000.

The Minerals Management Service has changed, too. Three directors have led MMS since our work began. The head of the ESP, Don Aurand, who originally sought the help of the NRC, also left for other challenges.

This report and all related efforts by the OCS Committee have been arduous. The Socioeconomics Panel found its task particularly difficult, largely because there was so small a base of relevant socioeconomics information to build on and because social and economic factors vary so much from one place to another and can change so quickly. These difficulties led the panel to recognize that one could not simply apply experiences gained from other studies of OCS impacts or even studies of other kinds of projects to any particular OCS region. Instead, the only useful course it could recommend was to use previous experiences to guide the development of a process for obtaining the needed information; the report outlines such a process in some detail. We recognize that this might be a disappointment to MMS, especially given the detailed recommendations provided by the Physical Oceanography and Ecology Panels. However, there does not appear to be a satisfactory alternative, despite the panel's prolonged and earnest efforts to find one. A credible, policy-relevant socioeconomics studies program cannot be built overnight from ready-made parts.

The difficulty of this report and of the other efforts of the OCS Committee is quite in keeping with the complexity, difficulty, and importance of the Offshore Oil and Gas Program for the United States. In its more than 20-year history, the ESP alone has expended more than $500 million to study the environmental, including socioeconomic, aspects of lease sales in OCS. This report concentrates

on the adequacy and applicability of the ESP's socioeconomic studies in meeting program goals during this period. It concludes with several recommendations the panel believes would improve performance in the socioeconomic realm and in the ESP.

During the course of its study, the panel visited coastal Louisiana; northern and southern California; and Anchorage, Dillingham, Aleknagik, Togiak, Cordova, and Valdez, Alaska. In those places, we received numerous briefings and had numerous discussions with many people, including private individuals; members of village, town, borough, and county governments; representatives of various commercial enterprises, including fishing, fish-processing, agriculture, and tourism; the oil industry, environmental organizations, and others; and federal and state agencies, including MMS. Others provided published documents and written information. We are enormously grateful to those who gave of their time and expertise; they taught the panel a great deal.

Naming all the people who helped the panel complete its task would be quite impossible, for they number in the hundreds. However, we would be remiss not to single out the extraordinary diligence, patience, and tact of David Policansky, the NRC staff program officer in charge of the OCS committee's work. He, and his immediate staff, Sylvia Tognetti and Holly Wells, have never wavered in the long road they and we of the Socioeconomics Panel have walked together.

We also wish to acknowledge the cooperation and helpfulness of MMS officials, the constructive comments of numerous anonymous reviewers, the technical assistance of those on the NRC's editorial staff, and the overall guidance of James Reisa, the director of the NRC Board on Environmental Studies and Toxicology.

Garry D. Brewer

Chairman, Socioeconomics Panel

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Executive Summary

Federal responsibility for oil and gas development on the outer continental shelf[1] (OCS) lies with the Minerals Management Service (MMS) of the U.S. Department of the Interior. The potential and realized value of the resource is large. From 1954 through 1990, the last year for which statistics have been published, OCS oil and gas accounted for more than 7.5% of total domestic oil production and about 14% of domestic natural gas. More than $97 billion in revenue went to the government in the form of cash bonuses, lease rental payments, and royalties on produced oil and gas. But the federal OCS leasing program has been controversial, especially since the Santa Barbara, California, oil spill in 1969. More recent accidents—although they have not involved OCS oil—have added tension to the debate.

The Minerals Management Service's Environmental Studies Program (ESP) is responsible for the conduct of environmental studies on the outer continental shelf and for collecting information used in environmental impact statements and to inform federal management decisions. The program began in 1973 as a project of the Bureau of Land Management to obtain ecological, physical oceanographic, and socioeconomics information. Approximately $540 million was spent through 1991 on a variety of studies, most of them performed by contractors. Studies labeled as "socioeconomic" have consumed about 5% of the ESP budget—on average, $1.4 million a year. The total expenditure for these studies through 1991 was $26.4 million. Some of those expenditures, however, have not been for the collection or analysis of social and economic information.

THIS REPORT

In 1986, MMS requested that the National Research Council (NRC) evaluate the adequacy and applicability of the ESP studies, review the general state of knowledge in the appropriate disciplines, and recommend future studies. Under the auspices of the NRC Board on Environmental Studies and Toxicology, the Committee to Review the Outer Continental Shelf Environmental Studies Program was formed to conduct the assignment. Three panels were established to review the ESP's work in ecology, physical oceanography, and socioeconomics. The Socioeconomics Panel investigated the main questions of the social and economic relevance of OCS oil and gas activities and the social and economic aspects of ESP. This report presents the findings and recommendations of the Socioeconomics Panel.

[1] The federal outer continental shelf extends from the seaward boundary of state jurisdiction, usually 3 miles, to 200 miles offshore.

The panel collected information from several sources. Presentations were given by the ESP staff members and independent scientists familiar with ESP's work. The panel also reviewed relevant scientific literature and documents that detail MMS's planning and implementation process for various lease sales. While this report was being prepared, the OCS committee and its panels interrupted their work in response to government requests to prepare two reports on the adequacy of environmental information for OCS decisions. The first report, requested by President Bush, deals with lease sales off the coasts of Florida and California; it was published in 1989. The second, requested by MMS, focuses on a North Atlantic lease sale; it was published in 1991. For this report, the panel reviewed documents that were available through mid-1991. The ESP continues to evolve, and MMS officials indicate that they are taking into account recommendations in the previous reports mentioned above.

THE HUMAN ENVIRONMENT AND MMS

MMS and other federal agencies charged with the management of the natural resources of the United States are increasingly being required by their enabling legislation and by other laws to assess the social, economic, and cultural effects of development and regulation. These are new tasks to MMS's scientific staff, which, outside of Alaska is made up mostly of engineers, biologists, and physical scientists. Developing a socioeconomics research program outside of Alaska has been problematic, but the Outer Continental Shelf Lands Act as amended in 1978 (OCSLA; U.S.C. 43 §§1331-1356, §§1801-1866) mandates the consideration of effects on the "human environment" in all decisions about the oil and gas leasing and development of offshore tracts. The act also requires monitoring of the effects on the human environment, which is defined in the act as "the physical, social, and economic components, conditions, and factors which interactively determine the state, condition, and quality of living conditions, employment, and health of those affected, directly or indirectly, by activities occurring on the outer Continental Shelf" (43 U.S.C. §1331 (i)). By this definition, the term includes not only those features of ecosystems as perceived by, related to, or modified by human populations, but the human populations themselves and their social, cultural, and economic systems. This simple characterization masks enormous complexity and requires some clarification before it can be used as the basis for evaluating—much less designing—a research program. The subject of the human environment is discussed in Chapter 2 and in Appendix B of the report.

WHY MMS NEEDS SOCIOECONOMIC INFORMATION

Compliance with OCSLA requires the government to have scientific information, including socioeconomic information. As an example of this need, we mention MMS's frequent statements that areas have been excluded from lease schedules because of their "environmental sensitivity." Although we are not aware of any case where it has been used, socioeconomic information is needed in the same way to evaluate whether an area should be excluded from lease schedules because of its socioeconomic sensitivity. For example, onshore development might threaten a unique or valuable cultural community or recreational value; the threat of spills might threaten a unique or valuable economic or cultural (including subsistence) activity; and so on. But without socioeconomic information, the necessary evaluations cannot be made.

Socioeconomic information is also needed to condition the terms of OCS operations and manage the impacts of OCS activities (e.g., MMS's seasonal drilling restrictions in the Beaufort Sea

to avoid affecting migrations of bowhead whales). Without this information, it is impossible to influence the degree of impact that OCS activities might have on local and regional economies and social systems or provide credible rules to deal with such impacts. Finally, obtaining socioeconomic information includes learning what people's concerns, fears, and desires are with respect to OCS activity, and that information seems to be a prerequisite for successful operation of the OCS oil and gas program.

Decisions about the use and allocation of public resources and risks seldom satisfy all members of the public. The panel is not suggesting that everyone can be satisfied with every decision about OCS activities. It is suggesting that the public's reactions to public decisions, in themselves, are socioeconomic impacts of the decisions and are a legitimate—indeed, essential—aspect of a socioeconomics studies program. In addition, a better understanding of these socioeconomic impacts could lead MMS to develop a decision-making process with fewer and smaller socioeconomic impacts than the current process.

A FRAMEWORK FOR ORGANIZING SOCIOECONOMIC STUDIES

What is the knowledge base on which MMS can predict and manage the effects of OCS activities on the human environment? The analytic problem of socioeconomic impact assessment is examined in Chapter 2. Following that, a framework for organizing OCS socioeconomic studies is presented in Chapter 3.

Identifying and Understanding Socioeconomic Effects

An effect, for the purposes of this report, is a change to existing conditions caused by a specific, identifiable action. This definition includes trend impacts. Socioeconomic effects include changes in the well-being of individuals from *their* perspective. What is actually or perceived to have changed varies widely, and what is threatened, put at risk, or improved by a proposal or by an action also varies widely. In the case of activities on the outer continental shelf, the risk could be as specific as an oil spill, or as general as the alteration of a way of life. Benefits can be as specific as the creation of jobs, or as intangible as "national security." A fundamental consideration is discussed in the first report in this series, on OCS gas and oil exploration and leasing in Florida and California:

> People conceive of possible impacts and perceive of their probabilities in terms of *their* environment as *they* experience it and not necessarily an environment constructed of features selected by an objective analyst. Because human socioeconomic systems are social and symbolic, people in different environments or milieus can have different views of those environments that are equally realistic. Because these views are real, they have real consequences (emphasis in original).

In addition to providing information about existing conditions in particular human environments, a framework for evaluating impacts must at a minimum examine four additional elements: actions that can cause effects, the possible reactions to them (responses), the dimensions of the impacts, and the potential incidence and distribution of impacts caused by OCS activities throughout the human environment. These are discussed in detail in Chapter 3 and in Appendix B.

What Information is Needed?

Assessment of the possible socioeconomic effects of OCS activity differs from the assessment of biological and physical effects in that significant socioeconomic effects can occur *before* a lease sale. The assessments are similar in that site-specific information should be obtained before decisions are made about development and production.

For all stages of the leasing process, information is needed on the human environment. What crucial aspects of people's lives do they perceive to be at risk? Basic information on the distribution and dimensions of effects also is needed. Because available data have usually been collected for purposes other than to assess the effects of OCS activities, they have three shortcomings for impact assessment: First, they are almost always collected for a political, economic, or socially delimited geographic unit, but unlike generalizations from these data sets, the effects of OCS activities and human activities generally do not conform to geographic boundaries. Second, the data are almost always collected for convenience; they are collected if people engage in activities that produce a record. Third, inasmuch as the data are organized for different purposes, it is difficult to link them. Socioeconomic data not collected specifically to assess the potential effects of OCS oil and gas leasing must be evaluated carefully to determine how useful they are.

In addition to information needed during the prelease and exploration stages, information should be gathered on the development, production, and termination stages. It should be possible to obtain more site-specific information after exploration; this heightens the need to collect data specifically related to the potential effects of the proposed activity. At this stage, it is important to know whether the assessment considers all five stages of the OCS oil and gas process (prelease, exploration, development, production, and termination) and whether it covers the dimensions of the potential effects adequately. It is possible and important to know whether the information permits identification of the relevant social groups and systems that will be affected.

The process of identifying the information needed for impact assessment and management is commonly called "scoping." In the scoping process, an agency receives many public comments on what is important. There is a tendency for agencies (and many other specialists) to dismiss public concerns as not being expert. This is probably appropriate in some cases; most members of the public are not expert on ocean currents, engineering, or population ecology. But *everybody* is an expert on her or his fears, desires, wants, needs, and values. And that is crucial when describing an approach to obtaining socioeconomic information. As in other disciplines, expert practitioners can provide expert advice, but unlike other disciplines, the public must be involved in setting the research agenda.

REGIONAL PROGRAMS

Atlantic

Many Atlantic region studies classified by MMS as socioeconomic address important issues, but they are primarily of a natural science or engineering nature. Few of the studies within the socioeconomic program have included socioeconomic *analysis* of effects or focused solely or even primarily on socioeconomics. The socioeconomic content of these studies consists mostly of secondary data, i.e., compilation and analysis of data collected for other reasons. Although important, secondary data do not constitute a socioeconomics program, and little of the effort in the region (with a few notable exceptions) is placed on socioeconomic analysis.

Gulf of Mexico

The panel found no systematic MMS program for identifying and analyzing important socioeconomic issues for study in the Gulf of Mexico region. With the exception of four projects, the socioeconomics studies in the Gulf consist of secondary-data collections. Collection of baseline data is an important first step in a socioeconomics program, but it does not constitute a program in itself. Furthermore, useful baseline studies must collect information needed to carry out socioeconomics analyses, including collection of primary data where appropriate, rather than being limited to data from secondary sources only.

An additional study in the Gulf region used collected data to implement an input-output model. Although they have been extensively criticized, input-output models can provide useful information. However, the panel has not been able to identify any actual applications of the input-output models in the Gulf. Information on economic effects of oil spills, although of limited scope, also can be useful in a socioeconomics program. Again, however, it is not clear how the results of the study of oil spill costs have been incorporated into an integrated program.

The northern Gulf of Mexico is the most heavily developed section of the outer continental shelf in the world, and a variety of social and economic effects of that development have been discussed in the literature. The most sweeping and readily identified effects of OCS activities in the United States have been in the social and economic arenas in the Gulf of Mexico. Certainly, there are significant lessons to be learned about OCS oil production from the Gulf of Mexico experience, including cumulative effects, some of which will transfer to other regions. Greater efforts should be made to learn from that experience.

Pacific

Although the panel did not find any systematic MMS program for identifying and analyzing important socioeconomic issues for study, the program in the Pacific goes beyond those in the Atlantic and the Gulf of Mexico in its attempts to apply socioeconomic analysis. However, modeling efforts in the Pacific region are small-scale computer analyses, rather than in-depth studies with primary data. The effort to incorporate actual primary data to calibrate or verify the models has been insufficient. Moreover, many of the studies have serious methodological problems.

Alaska

With the exceptions of the shortcomings noted below, MMS's Socioeconomic Study Program (SESP) in Alaska is extensive and substantive, consisting of 159 individual studies through FY 1992. Of the regions, only Alaska has what could be considered a true socioeconomics program. It has a systematic underlying conceptual structure, it gives a broad definition of the human environment, it has identified areas for further study, and it has integrated several studies to fulfill program requirements. The Alaska SESP is as good an example as any socioeconomics studies program found in a federal or state agency. There is no scientific basis for Alaska's program to be so much better than those in other regions, although some of the state's characteristics (its relatively small population, for example) make it easier to study than other regions.

However, there are some shortcomings in the program: Its noneconomic studies focus almost exclusively on native Alaskans, and the economics studies focus almost exclusively on macroanalyses of employment, income, and demographics. The program should be expanded to include social

studies of nonnative Alaskans, and its economics component should provide social cost analyses of oil spills, information on the potential effects of OCS activities on recreation and other activities, and analyses of the economic effects of OCS development. The Alaska program would be strengthened if there were stronger linkages among its various studies.

CONCLUSIONS

The Alaska region—despite some shortcomings—has a credible and comprehensive socioeconomics studies program. It has an underlying conceptual structure, offers a broad definition of the human environment, identifies study needs, and integrates its projects to fulfill program requirements. There is no such comprehensive program in the other three regions.

The perception of the human environment on which MMS studies outside Alaska have been based needs expansion. It seems to have been framed only in terms of economics, demography, and government. But adequate consideration of the human environment also must include sociology, culture (and anthropology), and psychology. Even the Alaska program, which surpasses those of the other regions by a large margin, needs a more comprehensive and integrated view of the human environment. Very little socioeconomics research has been done in the other three regions, even though all of the OCS oil and gas produced to date has come from the Gulf of Mexico and the Pacific regions.

External factors have influenced the development of such striking asymmetry among the four programs. In Alaska, the importance of native populations and their cultures is clearly recognized by and reflected in federal and state law. The population of Alaska is extremely small compared with the resources available to study it and with the potential value of OCS oil and gas. Socioeconomic studies are needed outside of Alaska for two reasons in addition to the clear mandate of OCSLA. First, because so much OCS oil and gas activity has occurred off the coasts of Louisiana, Texas, and California, a great deal could be learned by studying those places. Second, the vociferous opposition to leasing in many coastal states makes clear that a great deal needs to be learned.

The Alaska program cannot simply be copied to assess the affects of OCS activities in other regions, nor can the Tri-County Socioeconomic Monitoring Program—a county initiative in California—be copied to the Gulf of Mexico. The Alaska program evolved primarily to address questions that do not exist in the other regions. Activity in the Gulf of Mexico has passed the stage at which the monitoring of individual projects, as is done in southern California, is feasible. That region will require assessment and monitoring of cumulative effects.

In most regions, MMS will have to develop a program from a very small base of information. As a result, the panel cannot detail appropriate studies because the basic outlines of a program are missing in most regions, as are fundamental appraisals of the situations and needs in each region. However, the panel can recommend basic goals for such a program, delineate fundamental properties for a program, and describe a program development process for MMS and the larger scientific community.

RECOMMENDATIONS

Goals

To establish a national, comprehensive, credible socioeconomics studies program, MMS should begin with the following goals.

- Create a socioeconomic research program that is national in scope and, as a result, that can generalize applicable findings from one region to another. At the same time the program must account for regional variations in study design and implementation. The program must have an established scientific integrity.
- Use the program to collect the information required by OCSLA and necessary to elucidate the implications of OCS activities at all stages, from prelease to termination. The schedules of the planning process described in Table 1-4 and the timing of studies should be compatible with each other.

Scientific Personnel

To accomplish its goals, MMS needs to strengthen its in-house expertise in socioeconomic disciplines, especially outside of Alaska.

The scientific expertise of MMS's regional staff should match (at least approximately) the mix of studies funded in each region. Especially outside of Alaska, additional regional scientific staff will be needed to develop credible and useful studies of economics, sociology, and cultural anthropology, and political science. Developing credible socioeconomics programs outside of Alaska will require an increase in funding for socioeconomic studies.

Process

MMS should establish a process to identify, in general terms, the socioeconomics information it needs and a process to translate that description into a program of studies.

The basics of one approach to this process are outlined below. The approach is similar to, although more extensive than, the one used to develop the Alaska SESP.

- **Delineate the generic socioeconomic information needs of the agency.** Start by holding workshops or meetings between MMS personnel and members of the scientific community. The focus should not be on whether there have been or will be specific effects as a result of OCS activities, but on what effects could be included for consideration in a research agenda and on what methods could to use to assess them. It is important to keep the agenda broad and not to discuss specific studies at this stage.
- **Delineate regional variations to further define the research effort.** With the broad considerations in hand, regional workshops or meetings between MMS personnel, members of the scientific community, and members of the public should narrow the focus of the regional research agenda and to help set priorities. Until the agenda is conceptualized, individual studies should not be considered except as examples. It is essential to involve the public at this stage. Although it will not set the research agenda directly, the public is in the best position to know its concerns, fears, hopes, expectations, and values.
- **Translate the narrowed research agenda into specific studies in order of priority.** A better understanding of the issues should result from the first two steps. Cooperation with the

scientific community is still desirable at this stage, when the use of workshops, conferences, and seminars, and the work of consultants would be useful. In this, as in all other stages of the process, MMS must take advantage of scientific committee and regional technical working groups.

- **Revise standard MMS funding criteria and explore creative funding strategies for smaller studies.** Social science research is less likely than other kinds of studies to be funded according to the budget criteria MMS uses. Those criteria are most responsive to potential litigation, and, outside of Alaska, effects on the human environment have seldom ended up in the courts. Recent social science research projects funded by MMS through university initiatives in the Gulf of Mexico and Pacific regions are examples to adopt for other projects. Although these projects are focused regionally, they might benefit by being opened to proposals from researchers from all parts of the country.
- **Use the full range of social science methods to design specific studies.** These options include empirical research, often involving surveys and questionnaires, with the attendant necessity of receiving approval from the Office of Management and Budget. Secondary data analyses and community studies that have characterized past MMS research also are valuable tools that should continue to be used.

The most important aspect of the process outlined above is that a generic research agenda must be established, at least in some regions, before specific studies can be evaluated. Although Alaska's program was developed as the result of a workshop that involved the scientific community, it would also benefit from additional thoughtful participation from the scientific community and the public. The process described above will require time, patience, commitment, and some additional money to develop a viable research program. However, MMS has demonstrated by its actions in Alaska—and to some degree by aspects of its biological and physical studies elsewhere—that it is capable of success and that success need not take decades of require an enormous increase in its budget. To date, the alternatives have not worked very well.

Assessment of the U.S. Outer Continental Shelf Environmental Studies Program

III. Social and Economic Studies

1

Introduction

Since the beginning of the century, offshore drilling for oil and gas has made an important contribution to the energy resources of the United States. The need to balance the value of offshore oil and gas resources against the potential for the environmental damage that can attend their recovery has become increasingly recognized in federal law and in the national debate over energy.

The federal offshore leasing program has been a source of controversy since the 1940s, when the federal government began to assert public ownership of offshore resources. Conflicts pertained mostly to questions of the ownership of resources and to the distribution of costs and benefits among local, state, and federal governments. Potential environmental damage from the activities associated with oil and gas leasing of the outer continental shelf (OCS) also was largely a local concern until 1969, when a spill resulted from a blowout at a Union Oil platform. Over 3 million gallons of oil has been released into California's Santa Barbara Channel (MMS, 1991a) and the accident brought environmental concerns to national attention (Congressional and Administrative News of the U.S. Code, 1978). The spill affected 150 miles of coastline (Nash et al., 1972). Other oil and gas accidents have caught the public's attention, even though they have not involved the U.S. OCS. Two accidents drew wide public notice in the United States. The first, on June 3, 1979, was the blowout of the Mexican exploratory offshore well *Ixtoc I*. It released more than 150 million gallons (500,000 tons) of oil and natural gas—at the time the largest accidental oil spill in history[1] (NRC, 1983a). The second was the grounding of the tanker *Exxon Valdez* on March 24, 1989. It released about 11 million gallons of North Slope crude oil into Alaska's Prince William Sound. Even though the *Exxon Valdez* accident did not involve OCS oil, its effects on the OCS debate are clear.

The U.S. petroleum resource is valuable. From 1954 through 1990, the last year for which there are statistics, the offshore petroleum industry provided almost 7.5% (8.8 billion barrels[2]) of all domestic oil and about 14% (93 trillion cubic feet) of domestic natural gas. It accounted for more than $97 billion in revenue from cash bonuses, rental payments, and oil and gas royalties (MMS, 1991b). In 1990 alone, 12.1% (324 million barrels) of domestically produced oil came from the outer continental shelf, and it was the source of 27.6% (5.1 billion cubic feet) of domestic natural gas. In 1990, it provided more than $3 billion (Table 1-1) of the total federal revenue of more than $1 trillion, or 74% of all royalties collected (MMS, 1991b, c).

[1] The preliminary estimate is that more than 450 million gallons of crude oil spilled into the Persian Gulf from Kuwait's Sea Island Terminal in late January 1991, during the war in the Persian Gulf.

[2] One barrel of oil contains 42 U.S. gallons.

TABLE 1-1 OCS Revenue by Region, 1990

Region	Amount
Gulf of Mexico	$3,237,287,758
Pacific	113,932,232
Atlantic	1,179,648
Alaska	15,339,181
Total	$3,367,738,819

Source: MMS, 1991b

ACTIVITIES ON THE OUTER CONTINENTAL SHELF

Management of OCS Activities

OCS leasing is managed by the Minerals Management Service (MMS) of the Department of the Interior. MMS was formed in 1982 to consolidate responsibility for offshore oil and gas development in one agency. Before 1982, the task was shared by the Bureau of Land Management and the U.S. Geological Survey. Federal responsibility for the development of mineral resources and the conservation of natural resources on the outer continental shelf was established by the Outer Continental Shelf Lands Act (OCSLA) of 1953 as amended in 1978 (43 U.S.C. 1331-1356, 1801-1866) and the by Submerged Lands Act of 1953 (43 U.S.C. 1301-1315).

The schedule for the sale of leasing rights is established in accordance with a five-year plan that stipulates the size, timing, and location of proposed leasing activities. The plan is developed in a two-year process that includes consultation with the governments of coastal states, federal agencies, and the public. Beginning in 1983, MMS offered lease sales for entire areas rather than for selected tracts so that the number of blocks and leases was increased and drilling of more exploratory wells in frontier areas, such as areas of deep water, was encouraged. (The current plan proposes a new "area evaluation and decision process" to be more selective than earlier plans were about which areas will be available for lease and more responsive to the views of affected parties, except in the central and western Gulf of Mexico, where nearly all unleased acreage will be offered annually.) The current proposed plan, effective from 1992 to 1997, lists 18 sales in 11 of the 26 OCS planning areas (see Figures 1-1 and 1-2) (MMS, 1992a). Other areas were designated for possible study subject to leasing decision needs and budgetary constraints.

Extent of the Leasing Program

Between 1954 and 1990, 102 lease sales offered 148,456 OCS tracts that contain 781,684,261 acres in four regions—Alaska, the Atlantic, the Gulf of Mexico, and the Pacific. Only 12,326 (8.3%) of those tracts—in all, 63,512,799 acres (8.1% of the total acreage offered—were actually leased. Table 1-2 provides a regional breakdown of lease offerings and sales between 1954 and 1990.

In 1990, of 6,163 active leases, 1,717 (25%; 8,044,618 acres) were producing oil or gas. To date, all producing leases have been in California or in the Gulf of Mexico, although some in Alaska have proven reserves. OCS production first began in the Gulf of Mexico in 1954. California OCS wells did not begin to produce until 1968. Tracts on federal lands in the Alaska and Atlantic regions were first leased in 1976 but have not produced to date. There has been considerable production in state tracts in Alaska, California, and the Gulf of Mexico. Table 1-3 shows, by region, the number of active leases in 1990. Through 1990, 4,601 platforms had been built and 788 had been removed, leaving 3,813 in place (MMS, 1991a). All but 23 of the platforms were in the Gulf of Mexico.

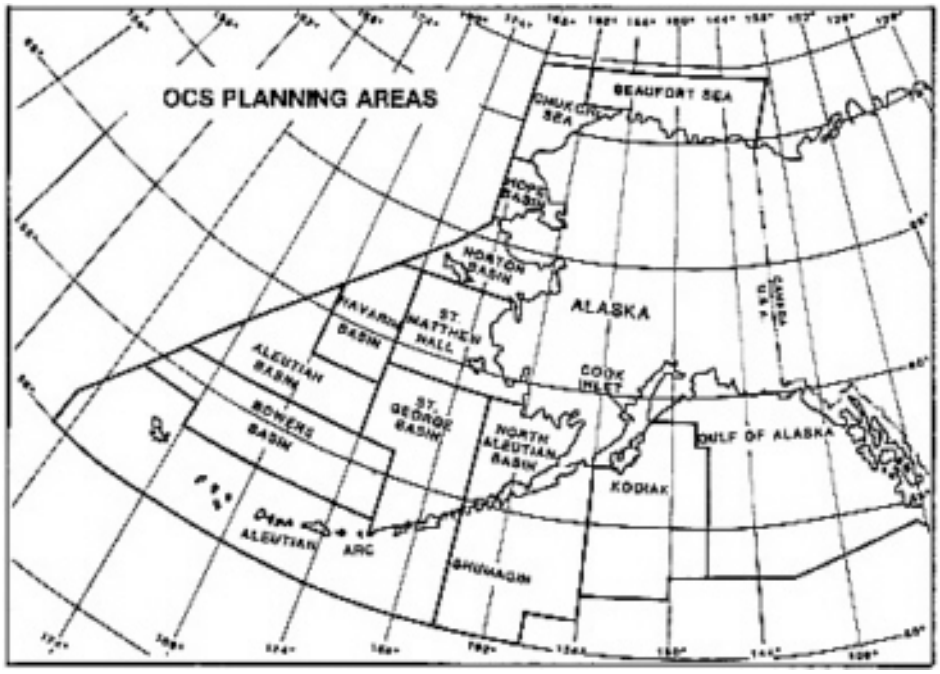

Figure 1-1
Outer Continental Shelf planning areas (Alaska). Source: MMS, 1987a.

Figure 1-2
Outer Continental Shelf planning areas (contiguous United States). Source: MMS, 1987a.

TABLE 1-2 OCS Lease Offerings and Sales, 1954-1990

		Leases Offered		Leases Issued		Percentage Leased	
Region	Number of Sales	Tracts	Acres	Tracts	Acres	Tracts	Acres
Alaska	13	17,451	96,232,365	1,480	8,175,771	8.5	8.5
Atlantic	8	8,773	49,317,339	384	2,186,183	4.4	4.4
Gulf of Mexico	70	120,356	626,464,878	10,002	50,667,765	8.3	8.1
Pacific	11	1,876	9,669,679	460	2,483,080	24.5	25.7
TOTAL	102	148,456	781,684,261	*12,326	*63,512,799	8.3	8.1

*The Department has held 2 reoffering sales of onshore oil and gas lease areas: RS-1 reoffered 175 tracts (996,308 acres), Alaska; RS-2 reoffered 140 tracts (785,091 acres), Alaska; 155 tracts (822,444 acres), mid-Atlantic; 232 tracts (1,320,819 acres), South Atlantic; and 27 tracts (153,716 acres), northern and central California.
Source: MMS, 1991a.

TABLE 1-3 Active OCS Leases, 1992

Region	Active Leases	Percentage of Active Leases	Acres Leased	Percentage of Acres Leased
Alaska	894	14.5	4,955,874	15.7
Atlantic	61	1.0	347,284	1.1
Gulf of Mexico	5,098	82.7	25,746,739	81.4
Pacific	94	1.5	475,950	1.5
Total	6,147	100.0	31,525,847	100.0

Source: MMS, 1991a.

Environmental Concerns

Potential effects of oil spills that result from OCS development and production on coastal resources such as fisheries, endangered species, and marine wildlife are a major source of public concern. Other sources of potential harm associated with OCS development include the discharge of produced water and drilling muds, the chronic loss of oil at the drilling site, and the damage associated with construction of support facilities in coastal areas. Seismic surveys, erection of platforms, and placement of pipelines can interfere with commercial, recreational, and subsistence fishing. Vessel traffic and the laying of pipelines contribute to coastal erosion, especially in the marshy areas of the Gulf of Mexico (Turner and Cahoon, 1988). The potential for long-term,

chronic environmental damage also exists, and many potential and actual effects are discussed in earlier NRC reports (NRC, 1983a, 1985, 1989a, 1991b).

Potential socioeconomic effects—changes to the human environment—attend all phases of OCS activity. The concept of the human environment, as defined by OCSLA as amended in 1978, includes the "physical, social, and economic components, conditions, and factors which interactively determine the state, condition, and quality of living conditions, employment, and health of those affected, directly or indirectly, by activities occurring on the outer Continental Shelf" (43 U.S.C. §1331 (i)). This concept is further defined in Chapter 2 of this report and discussed more fully in Appendix B. Some socioeconomic effects result directly from biological and physical changes, or are the result of public concerns about them. Conflicts over the distribution of the costs and benefits of OCS activities, space conflicts between different users of the ocean, siting of industrial facilities in coastal areas, alterations to subsistence fishing in rural Alaska, economic dependence on OCS activities in coastal communities, impacts on educational levels, changes in the tourism industry, and fear and uncertainty about anticipated changes in the quality of life when a lease sale is announced can occur.

The effects on the physical environment of oil spills and other OCS operations have been the subject of previous NRC reviews (NRC, 1975, 1978, 1983a, 1985, 1989a, 1990, 1991a); this report addresses their effects on the human environment.

THE ENVIRONMENTAL STUDIES PROGRAM

Mandate

As amended in 1978, OCSLA (43 U.S.C. §1344) requires MMS to manage the oil and gas leasing program in light of the economic, social, and environmental value of the renewable and nonrenewable resources in the outer continental shelf; the marine, coastal, and human environments that could be affected; the laws, goals, and policies of affected states; and the equitable sharing of developmental benefits and environmental risks among the various regions. The timing of leases and their locations must be selected, to the maximum extent practicable, to balance the potential for environmental damage with the potential for extraction of oil and gas.

To balance the benefits of the leasing program with environmental risks, MMS must conduct studies that develop the information needed for "the assessment and management of environmental impacts on the human, marine, and coastal environments of the OCS and the coastal areas that may be affected by oil and gas development" (43 U.S.C. Sec. 1346 (a)(1)). MMS also must monitor the human, marine, and coastal environments of leased areas "in a manner designed to provide time-series and data-trend information which can be used for comparison with any previously collected data for the purpose of identifying any significant changes in the quality and productivity of such environments, for determining trends in the areas studied and monitored, and for designing experiments to identify the causes of such changes" (43 U.S.C. §1346 (b)).

In addition, the secretary of the interior must "submit to the Congress and make available to the general public an assessment of the cumulative effect of activities…on the human, marine, and coastal environments" (43 U.S.C. §1346 (e)). The same section requires the secretary to establish procedures for conducting the required studies. OCSLA as amended in 1978 (43 U.S.C. §1334 (a)(8)) requires the secretary to regulate activities to ensure that they do not prevent attainment of the Clean Air Act's National Ambient Air Quality Standards (P.L. 101-549 §109).

The secretary must then use the information required by these sections to support leasing decisions, to promulgate regulations, to set lease terms, and to establish operating procedures for OCS

activities (Congressional and Administrative News of the U.S. Code, 1978; 43 U.S.C. §1346 (d)). Information from environmental studies is used to support permitting decisions as well. Separate permits are required before geological and geophysical surveys may be conducted or exploration, development, or production begin. Exploration, development, and production plans must be submitted to MMS together with environmental reports and certificates of consistency with state coastal zone management plans.

The information also serves as the basis for ensuring compliance with other environmental laws, such as the National Environmental Policy Act (NEPA) (42 U.S.C. §4321-4347), which requires federal agencies to "utilize a systematic and inter-disciplinary approach which will insure the integrated use of critical and social sciences and the environmental design arts in planning and in decision making which may have an impact on man's environment" and to prepare environmental impact statements based on that information before taking major federal action. In its environmental impact statements, the development agency is required to consider realistic alternatives to proposed actions. Other environmental laws applicable to OCS activities include the Endangered Species Act of 1973 (16 U.S.C. §1531-1543, 50 CFR 17) and the Marine Mammal Protection Act of 1972 (16 U.S.C. §1361-1407, 50 CFR 216), which require MMS to consult with the Fish and Wildlife Service and the National Marine Fisheries Service to ensure that OCS activities do not destroy critical habitat or cause other significant harm to marine mammals and endangered species. The Coastal Zone Management Act (16 U.S.C. §1451-1464) as amended in 1990 makes leasing decisions subject to consistency certification. The Federal Water Pollution Control Act Amendments of 1972 (33 U.S.C. §1251-1375; P.L. 92-500), the Alaska National Interest Lands Conservation Act (16 U.S.C. §3101-3233; P.L. 96-487), the National Historic Preservation Act (16 U.S.C. §470-470w6; P.L. 89-665), and the Marine Protection, Research and Sanctuaries Act of 1972 (33 U.S.C. §1401-1445; P.L. 92-352) also affect offshore leasing.

Program History

The Environmental Studies Program (ESP) was established in 1973, in large part to comply with the requirements of NEPA. A more extensive history of the federal government's OCS program is given in Appendix C. From its inception (it was administered until 1981 by the Bureau of Land Management) through 1991, ESP has invested more than $539 million in research funds. Annual appropriations for the program have averaged about $30 million but recently have declined. Most studies are performed by external contractors (MMS, 1988a). MMS's Branch of Environmental Studies in Herndon, Virginia, coordinates the programs of the four regions: Alaska, the Pacific, the Gulf of Mexico, and the Atlantic. The regional offices (in Anchorage; Ventura, California; New Orleans, Louisiana; and Herndon, Virginia) define and contract for most of the studies. Socioeconomic studies have accounted for approximately 4% of ESP's budget, an average of less than $1.5 million a year. Almost 70% of the national budget for socioeconomic studies has been spent in the Alaska region.

In response to an NRC review (NRC, 1978), the program was restructured in 1978 to provide more immediately usable results for leasing and management decisions and to provide a framework for establishing study priorities (MMS, 1987b). A more detailed discussion of the regional programs appears in Chapter 4. Under the mandate to establish procedures for conducting environmental studies, guidance was developed by an OCS ad hoc advisory committee and published in "Study Design for Resource Management Decisions: OCS Oil and Gas Development and the Environment" (BLM, 1978); it was adopted by the OCS Advisory Board (Figure 1-3) on April 29, 1978. The document requires identification of management decisions and development of studies to provide the information needed for making those decisions.

The national OCS Advisory Board was established by the secretary of the interior in 1975 to provide guidance and recommendations on the leasing and development process, to receive comments and recommendations from state officials and other interested parties, and to provide a forum for discussion among federal agencies. The board consists of a policy committee, a scientific committee, and at least one regional technical working group for each region (the Atlantic region has three because it has 14 coastal states). The board reviews political, scientific, and technical aspects of OCS development and attempts to balance state, local, federal, public, and private interests. The scientific committee was established specifically to provide guidance and to review the ESP. The regional technical working groups make recommendations for the entire leasing and development process (including the ESP) (MMS, 1987c).

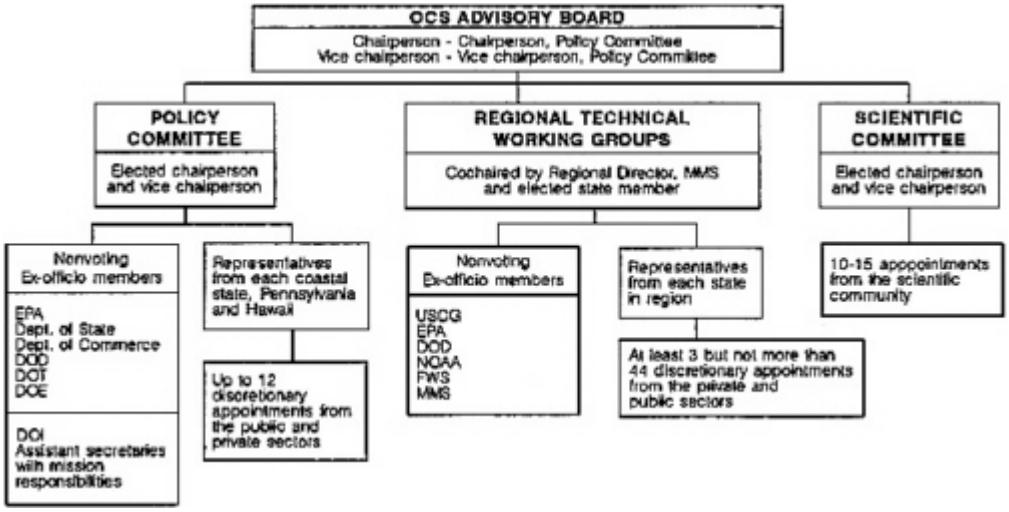

Figure 1-3
Outer Continental Shelf Advisory Board organizational chart. Source: MMS, 1987a.

The goals of the ESP are as follows (Aurand, 1988):

- Provide information that can be used to predict the effects of OCS oil and gas development.
- Provide information about the ways and the extent to which OCS development can affect the human, marine, biological, and coastal environments.
- Ensure that information that is already available or being collected for the program is in a form that can be used in the decision-making process associated with a specific leasing action or with longer term OCS management responsibilities.
- Provide a basis for future environmental monitoring of OCS operations, including assessments of the short-term and long-term effects attributable to the OCS oil and gas program.

THIS REPORT

In 1986, MMS requested a review of ESP that would recommend future directions. In response, the NRC Board on Environmental Studies and Toxicology formed the Committee to Review the Outer Continental Shelf Environmental Studies Program. Its members are experts in ecology, energy production, geochemistry, marine geophysics, oilfield technology, geology, law, physical and biological oceanography, public policy, and resource management. Its charge is fourfold:

- Provide an unbiased, independent evaluation of the adequacy and applicability of the studies used to inform leasing decisions and the prediction and management of the environmental effects of OCS oil and gas activities.
- Offer specific recommendations for future ESP studies.
- Identify issues about which there is sufficient information.
- Provide a state-of-the-art review of the available information relevant to the program.

Three panels were established to examine the specific subject areas of physical oceanography, ecology, and socioeconomics (NRC, 1990, 1991a). This report evaluates the ESP's socioeconomic studies and includes recommendations for areas the program should pursue.

The main objectives of the Socioeconomics Panel's evaluation are as follows:

- Provide an unbiased, independent evaluation of the adequacy and applicability of ESP's socioeconomic studies.
- Provide specific recommendations for future ESP socioeconomic studies.
- Provide a state-of-the-art overview of available information on each major issue reviewed, based on MMS studies, other relevant data bases, and the technical literature.

The panel's members recognize that ESP is not intended to be a broad, general science program, but is designed instead to study questions about the environmental and socioeconomic effects of oil and gas exploration and production. Nonetheless, the answers to those questions must be based on sound science.

The remainder of this chapter describes ESP. Chapter 2 describes the potential effects of OCS activities on the human environment. Chapter 3 describes an ideal socioeconomic studies program. Chapter 4 comments on the current program in the four regions. Conclusions and recommendations are provided in Chapter 5. Appendix B provides an extensive treatment of the human environment and effects on it. Appendix C discusses the evolution of the federal OCS program from national and regional perspectives.

PLANNING AND PROCUREMENT OF ENVIRONMENTAL STUDIES

Development of a Studies Plan

In 1978, MMS developed a framework for setting study priorities, based on the importance of the study for decision making, timeliness, generic applicability of results, availability of information, and applicability to issues of regional or program concern. To develop a list of topics, MMS identifies issues, primarily through the regional offices and with the help of advisory groups (including the regional technical working groups and the scientific committee) and interested parties

(environmental groups and industry associations). ESP staff members then translate the issues into questions that reflect the information needed for decision making.

Regional MMS offices, with help from the advisory groups, evaluate the resulting list of study topics for scientific and technical feasibility, availability of information, scientific merit, and the time during which or by which the information is needed. The list of study topics is reviewed by other federal agencies and by scientists in the academic community, in state and local governments, and in industry. After the review is finished, each regional office submits a draft regional studies plan to the Branch of Environmental Studies in Herndon, VA. The plan includes a statement of regional needs for information, the regional perspective on the priorities of these needs, a ranked list of proposed study topics, and a brief description of the rationale for each proposed study. The branch in consultation with the regions develops a national studies list from the proposed study topics and ranks them for funding priority based on criteria that include consideration of how the proposed study fulfills legislative mandates and other legal requirements and whether the study will be completed in time for use in specific leasing decisions. Contracts for the studies are then funded by MMS from its appropriated budget according to rank, until funds are exhausted. Since 1982, MMS has provided support for the review, publication, and dissemination of ESP results, including publication in peer-reviewed journals (pers. comm., MMS, 1989). Study contracts are awarded to private industry, universities, research institutes, and nonprofit organizations. The procurement process normally is competitive and is based on requests for proposals and associated statements of work prepared by MMS.

Implementation of Studies According to Lease Sale Schedules

The planning process for individual studies has been governed primarily by a lease sale schedule, which is established in a five-year planning document. Studies must begin well in advance of a lease sale or any other decision they are intended to support if they are to be useful. A prelease, 15-month-long study normally would be included in a regional studies plan approximately 34 months before the beginning of the lease sale process, which begins with the identification of areas that are believed to contain oil or gas. Table 1-4 is a sample schedule for a prelease study (pers. comm., MMS, 1988); the actual timing varies for individual studies and lease sales.[3]

WHY MMS NEEDS SOCIOECONOMICS INFORMATION

The Outer Continental Shelf Lands Act as amended in 1978 mandates a balance between the use of mineral resources and the protection of the human, marine, and coastal environments. Thus, compliance with OCSLA requires the government to have scientific information, including socioeconomic information.

As an example of a need for socioeconomic information, we mention MMS's frequent statements that areas have been excluded from consideration for leasing because of their "environmental sensitivity" (the "flower gardens," a biologically diverse area of the seafloor in the

[3] The committee has not had time to evaluate MMS's Area Evaluation and Decision Process (AEDP), which appears to change to some degree the sequence of events leading to a leasing decision. According to MMS (1992b), the AEDP "provides a framework for the activities which precede the decision of whether and under what conditions to hold an individual OCS gas and oil lease sale."

TABLE 1-4 Planning and Implementation Steps in the OCS ESP and Lease Sale Process

Month	Step
-34	Draft regional study plan.
-30	Final regional study plan.
-27	National study plan.
-20	Procurement plan.
-17	Draft statement of work.
-12	Final statement of work.
-7	Request for proposal.
-3	Contract.
0	Area identified.
1	Call for information: MMS publishes notice of intent to prepare EIS in the *Federal Register*. Industry invited to indicate areas of interest. Interested parties comment on topics and areas of concern. No decision is made about proceeding with sale.
5-9	Identification of area to be analyzed in EIS, identification of alternatives for EIS, estimation of resources, and preparation of oil spill report for proposed action and for alternatives. Draft report of study results.
12	Draft EIS and final report of study results to describe planning area, analyze potential environmental effects of oil and gas leasing, and discuss mitigating measures proposed to resolve conflicts. Public comment period.
13	Public hearing—opportunity for oral comments on draft EIS.
14	Close of comment period on draft EIS.
18	Final EIS to assess comments from the state and the public. Secretarial issue document prepared to analyze all issues involved in the proposed sale and possible coastal zone consistency conflicts. The SID and the EIS are sent for review by the assistant secretary and for decision on whether to issue a proposed notice of sale.
19	Proposed notice of sale details terms and conditions of proposed sale, blocks proposed for leasing, stipulations and other mitigating measures to be required, and proposed bidding systems
21	Governors' comments used by MMS to develop recommendations to the secretary. SID and final EIS sent to the secretary. The secretary is required to accept the recommendations of a governor if he determines that they provide a reasonable balance between the national and state interest.
22	Final notice of sale published at least 30 days before sale, specifies date, time, location, blocks to be offered, and terms and conditions of sale.
23	Sale—sealed bids opened and read by regional director.
24	Bid review—high bids evaluated to ensure receipt of fair market value. Sale results also reviewed by U.S. Department of Justice to ensure that lease awards do not violate antitrust laws.
25	Leases issued—bids accepted or rejected within 90 days of receipt. Leases issued for accepted bids 30 to 60 days after sale.

In this example, five years elapse from the completion of the draft regional study plan to the lease sale.
The postlease process includes evaluation of the exploration plan and approval for a drilling permit, evaluation and approval of the development and production plan, issuance of a pipeline permit, and termination or expiration of the lease.
Source: Information provided to NRC staff by MMS, 1988.

Gulf of Mexico, for example). President George Bush used that reason, among others, for deferring Sale 116, part 2, in a June 26, 1990, decision (Bush, 1990). Although we are not aware of any case where it has been used, socioeconomic information is needed in the same way to evaluate whether an area should be excluded from lease schedules. For example, onshore development might threaten a unique or valuable cultural community or recreational area or the threat of a spill would endanger a unique or valuable economic or cultural (including subsistence) activity. But without socioeconomic information, the necessary evaluations cannot be made.

Socioeconomic information also is needed to set the terms of OCS operations and to manage the effects of OCS activities (an example is seasonal drilling restrictions imposed by MMS in the Beaufort Sea to avoid effects on migrations of bowhead whales). Otherwise, it is impossible to influence the degree to which OCS activities can alter local and regional economies and social systems or to provide credible rules for dealing with such effects. Finally, the body of socioeconomic information includes people's concerns, fears, and desires about OCS oil and gas operations, and accounting for that information seems to be a prerequisite for the successful operation of an OCS oil and gas program.

What Information is Needed?

The next step is the question of the basic identification of the information needed. In the broadest sense, decision makers need enough information to predict what might be affected by OCS activities and to assess the effects of past OCS projects. A basic inventory of social, cultural, and economic variables would include identification of interests that might be affected. A general characterization of the local population would contain data about age, gender, income, occupation, religion, ethnicity, and world-view; attitudes toward the coastal environment, toward OCS activities, and toward government decision making; social arrangements; institutional arrangements; and the uses of the coastal and marine environments. Also needed is information about how the various stages of OCS activities might affect those social and economic variables. This last area would include an analysis of potential long-term and cumulative effects.

Information on the variables can be obtained from published studies, surveys, interviews, and government records. Potential OCS effects in an area can be elucidated by the study of current and past OCS activities elsewhere. Although in many cases such information can be obtained from prior studies, new studies will always be required, because all cases and periods differ in some ways.

Criteria for Judging the Adequacy of Scientific Information

The panel's operational definition of "adequacy" for scientific information has two aspects: completeness and scientific quality.

Completeness

The body of scientific information grows through research and discovery. Recognizing this continuing process, the panel's criteria for completeness require appropriate breadth and depth of basic scientific information in all relevant disciplines needed to elucidate the environmental risks associated with OCS decisions. These criteria are described in Chapters 3 and 4.

Scientific Quality

The standards of scientific quality are reproducibility, reliability, and validity of measurements and analyses, including appropriateness of methods and subject. The measure of scientific quality used by the panel was whether the methods described represent the current state of good practice in the scientific field (whether they would be likely to pass peer review). This does not imply that the objective is publication in a peer-reviewed journal, but rather that the quality of the data and scientific interpretations used in the studies that support OCS decisions should meet this basic scientific standard.

2

The Human Environment

The Minerals Management Service (MMS) and other federal agencies charged with managing the natural resources of the United States increasingly are required by legislation to assess the social, economic, and cultural effects of development and regulation. As a result, some agencies are developing research agendas to address these responsibilities and to determine what socioeconomic data are needed to discharge them. These agencies also are developing methods for collecting data and for devising ways to interpret and integrate the data into the decision-making process.

These are new tasks, and because MMS's scientific staff (outside of Alaska) is made up primarily of engineers, biologists, and physical scientists, developing a socioeconomics research program outside of Alaska has been difficult. But the charge to MMS is clear: The Outer Continental Shelf Lands Act of 1953 as amended in 1978 (43 U.S.C. §§1331-1356, §§1801-1866) mandates consideration of the human environment in all decisions concerning the leasing and development of offshore tracts. The term "human environment" as defined by the act includes not only the features of ecosystems as perceived by, related to, or modified by human populations, but the human populations themselves and their social, cultural, and economic systems. This simple characterization masks enormous complexity and requires some clarification before it can be used as the basis for designing or evaluating a research program. (Appendix B is a more extensive treatment of this topic.)

The concept of the human environment is essential in theory and in the practical requirements of the law governing activities in the outer continental shelf (OCS). There are no fundamental differences to separate the physical, natural, and social sciences. Where differences do occur, they usually are linked to the complexities characteristic of human systems (Baerwald, 1991).

The Minerals Management Service has access to nearly 50 years of experience drilling for oil and gas in coastal and offshore areas. These "data" about human decisions and behavior are important: They can shed much light on ways to resolve future conflicts. The problems that confront MMS are difficult and complex. Ranked high on the list must be the requirements to define the human environment as it interfaces with OCS activities. The difficulty is reflected in a general comment from Holden, published in *Science* magazine as "The Ecosystem and Human Behavior" (Holden, 1988):

> The task ahead is daunting. To begin with, appropriate data sources that integrate information from a variety of disciplines do not exist. Demographic data exist separately from data on land use or data on industrial policy. Knowledge from areas of study such as "risk perception," which bears on how people make decisions, would be introduced for the first time into many types of projections. The new program [in

> human dimensions of global change] would have a technology forcing effect, so to speak, on social science methodologies, which would have to be adapted to long-term, large-scale multi-disciplinary projects far beyond the customary scope of most disciplines.

Much basic, defining, and characterizing research needs to be done in the general realm of the human environment. Evidence here is contained in the various substantial recommendations for research into the nature of the human environment recently offered by the National Research Council's Committee on the Human Dimensions of Global Change (NRC, 1992). These recommendations are germane to MMS experience in anthropogenic changes to the natural environment and are similar to several recommendations made by this panel in earlier reports to MMS (NRC, 1989a, 1991a). For instance, the global change committee's report asks the following basic questions (NRC, 1991b):

- How do individuals, communities, businesses, and governments come to perceive changes in the environment as requiring action? How do they identify possible responses and assess the probable consequences of the responses? Are there cultural differences in the way different communities deal with the issues?
- Given the current need for national, regional, and local comparative studies, how do global studies fit in?
- Valuing consequences of environmental change: Valuation research should explicitly address the subjective nature of valuation and the phenomenon of differences in valuation, for instance, by exploring ways of soliciting valuations from different actors as part of the social decision process.
- Environmental decision making. To what degree are proposals likely to enhance understanding of processes of decision making and conflict management in response to global environmental changes?
- What techniques of conflict resolution or conflict management are likely to prove effective in coming to terms with environmental conflicts?

THE COMPLEXITY OF THE HUMAN ENVIRONMENT

Two areas of complexity in human systems are particularly relevant to this discussion. First, humans have a dual nature with respect to the environment: We are both "a biological species in an ecosystem," subject to ecological limits and dependencies, and "distinctly social" (Buttel and Humphrey, 1992). Like other species, humans depend on and affect nonhuman ecosystems (Hawley, 1950). Beyond such biological and physical connections, however, humans share at least four systems not fully developed in other species: the cultural, social, economic, and psychological systems.

Complexity also comes from what many observers see as the most distinctly human characteristic: the capacity to interpret the world—to develop, discern, and communicate meanings. For OCS projects—as for nearly everything humans experience—this means that from the moment a project is announced, or even rumored, the project affects the human environment. Although the disruption is not physical at first, its effects often are found in the opportunities and threats a project presents—or *appears* to present—to potentially affected groups.

Another predictable consequence is that in many cases the potentially affected groups begin to make politically charged claims about one another. Federal agency officials tend not to be passive

observers in this; they are among the most active participants in the process. In particular, agency staff members often are tempted to argue that the critics of agency policies are "emotional" or "misinformed" (Hance et al., 1988). These characterizations fail to acknowledge salient socioeconomic effects—and create new ones as well. They are "guaranteed to raise the level of hostility between community members and agency representatives and ultimately stand in the way of a successful resolution of the problem" (Hance et al., 1988). Such challenges can lead people to be resistant *in principle* to matters they might otherwise be willing to consider more dispassionately. This is all the more acute because the federal agencies' apparent failure to understand the public's concerns challenges communities' fundamental perceptions of reality. Furthermore, it is possible that for a community to have its reality disregarded by a powerful authority is profoundly alienating; it leaves no common ground on which the community and the authority can stand. The public often believes that the federal government fails to take its concerns seriously or even to understand them. Perceptions of the government's failure to pay attention and subsequent loss of popular trust in the government are common themes in public discussions of OCS development (and other activities, such as the development of nuclear power plants or hazardous-waste facilities) and are themselves socioeconomic effects. The human environment embraces the perceptions and behavior of individuals and groups: Studying it requires, in addition to economics and sociology, the disciplines of psychology, anthropology, and political science.

THE SYMBOLIC NATURE OF THE HUMAN ENVIRONMENT

The human environment includes a range of demographic, economic, physical, and social features and activities that are no less important for being relatively obvious, straightforward, and easily quantified. Examples include population size and distribution; birth, death, and morbidity rates and general conditions of health; patterns and rates of immigration and emigration; dominant economic activities; economic diversity; employment and unemployment patterns and rates; traffic patterns and capacities; tax bases; government services, including education, infrastructure maintenance, police protection, and recreational facilities; and tourism and recreation. In the main, MMS's research on the human environment outside Alaska has been confined to such features.

But any adequate description of the human environment also must account for its social, symbolic, and conceptual elements, which are established by convention rather than being "naturally" constituted. The conventional rules and practices of society are founded not only on narrowly focused, specific aspects of human affairs but also on the more general and, from the point of view of the actors, the more fundamental aspects of the social contract: morality, equity, justice, and honor; religious doctrine; ideas about sovereignty, property, rights, and duties; and aesthetic values and conceptions of what constitutes quality of life.[1] Added to this is the idea of the nature of nature, of the place of humans in it, of proper behavior with respect to it, and of the equitable distribution of its fruits and its dangers, and the costs of its stewardship. Assumptions about the nature of reality and of how knowledge is gained (or created) are also included. Indeed, a long tradition of research has examined the ways in which knowledge is socially produced and legitimated both in science (Kuhn, 1970) and in everyday life (Mannheim, 1936). Inasmuch as the development of an understanding of

the symbolic nature of the human environment requires fundamental research, it could be argued that MMS should not be held responsible for it. However, some research has been done, and its application to the prediction and management of the effects of OCS activities on the human environment is properly MMS's responsibility.

THE HUMAN ENVIRONMENT AND THE ENVIRONMENTAL STUDIES PROGRAM

The conception of the human environment upon which MMS studies have been based outside Alaska needs expansion. It seems to have been conceived only in financial, demographic, and government terms. But adequate consideration of the human environment and its complex human systems, constituted as they are of conventions, rules, and practices, as well as physical structures and features of the landscape, must rely on sociological, cultural (anthropological) and even psychological analyses. Even in Alaska, where the socioeconomics program has surpassed those of other regions by a large margin, there is a need for a more comprehensive and integrated view of the human environment.

The conception of the human environment must be sufficiently comprehensive to allow the full range of phenomena constituting human systems to enter into the analyses and to take into consideration the concerns of all interested parties, especially those who are likely to experience the social and economic effects of OCS activities most directly. It should, furthermore, be sufficiently consistent to make for reasonable commensurability between studies, thus facilitating extrapolation, comparison, and generalization, in short, encouraging learning from experience.

Although some of these considerations have in the past been ignored as esoteric, they have real implications for the way in which MMS does its business. Considerations of equity, justice, and honor were clearly evident in all the regions the panel visited, and were perhaps the major issues in northern California and Bristol Bay, Alaska. The aesthetics of offshore platforms and of onshore support facilities and structures is a major issue everywhere, but particularly in California and Florida. Debates over what constitutes "knowledge" and how it is produced in the agency were issues everywhere.

Decisions about the use and allocation of public resources and risks seldom satisfy all members of the public. In some cases, dissatisfied members resort to conflict of various types. The panel does not suggest that everyone can be satisfied with every decision about OCS activities. It does suggest that the public's reactions to government decisions are socioeconomic effects of the decisions and are a legitimate—indeed, essential—subject of socioeconomic study. In addition, a better understanding of these effects could lead MMS to develop a decision-making process that results in fewer and smaller effects than does the current process.

RISK

Risk is a central socioeconomic concept that runs through a variety of environmental problems and challenges. Why are individuals able and willing to accept risks in one circumstance when they are not in another, even objectively less threatening, circumstance?

The exciting intellectual and practical field of risk, taken to include a diversity of concepts and aspects, offers insight about how to come to terms with the stalemate in the OCS program. It is also one of the main ways in which the Environmental Protection Agency and other federal institutions are trying to come to terms and grips with difficult environmental decision making.

[1] For discussions of the ways in which this apparently vague concept has been assimilated into official government discourse all over the world, see Brewer and Brunner (1975) and Gross (1967). On problems of operationalization see Dalkey et al. (1970). On the general concept see Campbell et al. (1976) and Rappaport (1979).

What are the greatest risks to humans as a consequence of environmental changes, including natural ones we really cannot control and those for which responsibility can be assigned? This basic question is far from simple, either in its definitional complexities or in its operational implications.

Risk often is defined in terms of the probability of specific events occurring—based primarily on experiences with similar events, including their occurrence and consequences. Recent conferences and workshops organized by the National Research Council Committee on Risk Assessment Methodology can offer much help in providing intellectual clarification and practical application of risk assessment to a variety of circumstances and problems of the human environment. This important work bears clearly on the activities of MMS in its OCS program, where the consistent matter at issue is and always will be disputes about the kind and amount of risk that attends oil and gas exploration, development, and production.

To the extent that concerns and fears about human health and environmental matters are growing in importance, added political support can be marshaled to pursue scientific ends. Notice, however, the important distinction between "concern and fear" and rational assessment of probabilities. The difference between "real" and "perceived" risk is not as great as it might first appear (Freudenburg, 1988). Indeed, the formidable difficulties presented by perceptions of risk to managers in all segments of modern society are themselves an additional argument to link the human environment directly to the physical one.

Environmental Gridlock Resulting from Differing Perceptions of Risk

The Minerals Management Service does not operate in isolation when it comes to the strong reactions it stimulates in the public at large and in the specific places where it works. Strong local opposition occurs in many different environmental realms, some of them as deadlocked as the OCS program seems to be.

The longer term consequences of environmental gridlock are notable. They include erosion of public trust in national and local institutions (O'Hare et al., 1983; Baldassare, 1985), alleged economic losses (Cook, 1988), incidents of destructive and criminal behavior (Marshall, 1989), and even large-scale social pathology (Schwartz et al., 1985; Hickman, 1988).

Although this gridlock is difficult to deal with, practical lessons from it can be adapted to the OCS situation. The approaches to breaking down the impasse fall roughly into three sometimes overlapping categories: incentives, information, and involvement. No matter the approach, there is no simple or direct solution. Furthermore, all successful approaches appreciate a community's perceptions and fears, including those associated with risk.

The incentive approach is grounded in economic concepts of human behavior (Baumol and Oates, 1975) and is displayed in common economic realities (Shuff, 1988). Human attitudes and behavioral incentives have been linked to useful effect in economic and psychological theory (Francis, 1983) and in practical application in siting waste facilities (EPA, 1982).

The information-based approach typically emphasizes processes meant to reduce the gap between risk assessment and risk perception in the same or comparable circumstances (Krimsky and Plough, 1988). Some have even attempted to link economic costs and benefits to information programs designed to close the assessment-perception gap, and in so doing provide another illustration of socioeconomic concepts in constructive use for practical purposes of interest to MMS (Smith and Desvousges, 1990). The approach has even been rendered into "seven cardinal rules" rooted in the powerful concept of risk that, when taken together, comprise a good first approximation to a management strategy (EPA, 1988).

Management means involvement, and this active mode has theoreticians and practitioners. On the theoretical side there is a large and growing body of literature on negotiations and other alternatives to usual and costly litigation (Amy, 1983, 1987; Bingham, 1986). Economic and political theory, often combined, can be discerned in many of the practical efforts to involve disputants outside of a courtroom. Local successes (Elliott, 1984), statewide involvement and solutions (Chertow, 1989), regional illustrations from the Pacific Northwest (Fraidenburg, 1989; Lee and Halbert, 1990), and concerted national efforts, as in Japan, exist and serve as suggestive management models for those in MMS (Hershkowitz and Salerni, 1987). This powerful concept even extends to the international arena (Shubik, 1986).

Social theory illuminates basic conditions under which people will accept risk. One simple scheme emphasizes nine dimensions that are associated with the acceptability of risks to the public (Table 2-1).

TABLE 2-1 Dimensions of Risk, Their Perception, and Acceptance

Dimensions	More Acceptable	Less Acceptable
1. Volition	Voluntary	Involuntary
2. Severity	Commonplace	Catastrophic
3. Origin	Natural	Human-caused
4. Effect	Delayed	Immediate
5. Pattern	Occasional exposure	Continuous exposure
6. Control	Controllable	Uncontrollable
7. Familiarity	Old, familiar	New, unfamiliar
8. Personal	Clear benefit	Unclear benefit
9. Necessity	Essential	Luxury

Source: Portney, 1991. Reprinted with permission from *Siting Hazardous Waste Treatment Facilities*; copyright 1991, Greenwood Publishing Group, Westport, CT.

Even cursory examination of this simple table helps one understand a few of MMS's fundamental challenges. Most perceptual cues are in the "Less Acceptable" column. The interpretation here is that more careful examination of the evidence might help to move perceptions from the less to the more acceptable categories. Lacking careful analysis and faithful presentation of the historical facts, however, there is little reason to expect those without first-hand and direct experience to substitute realistic assessment for fearful perceptions. And generally, they do not.

This discussion of risk leads to four main conclusions:

- Socioeconomic theories exist relevant to a general class of problem facing MMS—its difficulty in proceeding with its OCS oil and gas leasing program.
- "Success," considered as any improvement over gridlock in decision making, exists in several fields comparable to offshore oil and gas activities.
- Such successes as there are occur only when those responsible realize that risk perception and communication are as important as the objective assessment of risk.
- The human environment is essential and central, not discretionary and incidental, in all matters related to the "not in my back yard," or NIMBY, syndrome, which clearly applies in part to the OCS.

3

A Framework for Organizing OCS Socioeconomic Studies

The subject of discussion here is the charge to the Department of the Interior's Minerals Management Service (MMS) to predict and manage the effects of outer continental shelf (OCS) activities on the human environment. To do this, MMS must acquire socioeconomic information. The first step is to decide what kind of information is needed—a difficult task, because the foundation on which to build is so meager. Enough is known already about physical oceanography and ecology that the additional information needed to predict and manage the effects of OCS activity on the physical environment can be described. Information about bowhead whales is not needed in the Gulf of Mexico, and information on sea turtles is not needed in Alaska. But it cannot be said that information on subsistence lifestyles is not needed in coastal Louisiana or that information on tourism is not needed for Alaska's North Slope. What is clear is that, as is the case for ecology and physical oceanography, different aspects of the human environment will be more or less important in different places. Therefore, instead of laying out a detailed list of the information MMS should obtain—an obvious impossibility at present—the Socioeconomics Panel here describes an approach that, if carefully applied by knowledgeable people, will lead to the development of a studies program that is responsive to the requirements of the Outer Continental Shelf Lands Act as amended in 1978 (43 U.S.C. §§1331-1356, §§1801-1866) and MMS's needs. The generally high quality of the socioeconomics program in MMS's Alaska region is evidence that the task is feasible.

The process of identifying the information needed for impact assessment and management (often called "scoping") comes from the requirement of the National Environmental Policy Act of 1969 (NEPA; 42 U.S.C. §§4321-4347) that lead agencies undertake "an early and open process for determining the scope of issues to be addressed and for identifying significant issues related to a proposed action" (Council on Environmental Quality, 1980). In this process, agencies receive many public comments on what is important. There is a tendency for those who work in federal agencies (and many other specialists) to dismiss public concerns as inexpert. This assessment is accurate in some cases; most of the public is not expert on ocean currents, engineering, or population ecology. But *everybody* is an expert on her or his fears, desires, wants, needs, and values. And it is crucial for federal agencies to obtain this information and use it as part of the process of determining socioeconomic effects. Expert practitioners can provide expert advice, but more than for other disciplines, setting the socioeconomic research agenda requires public involvement.

IDENTIFYING AND UNDERSTANDING SOCIOECONOMIC EFFECTS

An effect, for the purposes of this chapter, is a change to existing conditions caused by a

specific, identifiable action. What is or can be changed varies widely, and what is threatened, put at risk, or improved by a proposal or by an action also varies widely. In the case of activities on the outer continental shelf, the threats can be as specific as the possibility of an oil spill on a beach, or as hard to define as the alteration of a way of life. The benefits can be as specific as the creation of jobs, or as intangible as "national security." A fundamental consideration is discussed in the first report of the OCS Committee (NRC, 1989a):

> People conceive of possible impacts and perceive of their probabilities in terms of *their* environment as *they* experience it and not necessarily an environment constructed of features selected by an objective analyst. Because human socioeconomic systems are social and symbolic, people in different environments or milieus can have different views of those environments that are equally realistic. Because these views are real, they have real consequences (emphasis in original).

In addition to giving a detailed baseline description of particular human environments, a framework for evaluating effects must at a minimum examine three additional elements: actions that can cause effects and the possible reactions to them, the dimensions of the effects, and the distribution of the effects throughout the human environment. (These are discussed in detail in Appendix B.)

OCS ACTIVITIES THAT CAN AFFECT THE HUMAN ENVIRONMENT

For the systems that have been the subject of most of MMS's research, it is probably a safe assumption that effects cannot take place until there has been an actual physical alteration of the environment. This is not true of the human environment. Humans and their social systems can and do respond to information concerning *prospective* changes in the physical, biological, and social environment. For the purposes of MMS this can be the announcement of a lease sale, a part of the analysis in an environmental impact assessment, or a remark by an MMS official quoted in a local newspaper. Alterations in social systems—*before any biological or physical change has occurred*—canresult in members of the public changing their behavior, sometimes drastically; these changes are included in the basic definition of an effect.

Freudenburg and Gramling (1992) call these effects "opportunity-threat impacts:; they happen as proponents and opponents of the action define the action either as an opportunity or as a threat. The contentiousness of the debates over lease sales in the Florida Keys, in northern California, and in Bristol Bay, Alaska, are evidence of opportunity-threat impacts, and no one who attended a hearing in one of those communities would doubt that people's lives had been altered, even though no change in the physical environment had yet occurred. These effects are real, and so are their consequences. The congressional and presidential moratoria that have all but shut down the federal OCS leasing program outside the central and western Gulf of Mexico and Alaska are among the consequences of such effects, which have not been adequately considered by federal agencies.

Another failure to consider the full range of effects on human environments comes about as analysts overlook the adaptability of humans and their social systems to a variety of circumstances. Unlike that for most biological or physical systems, the question for humans is usually not whether adaptation will occur, but what form the adaptation will take and what the consequences of that adaptation will be. For the purposes of MMS, the coastal Gulf of Mexico offers an illustration. The human environment there has been changed by the offshore oil and gas activities of more than four decades. Although the adaptability of humans (made possible by the human culture) is part of the

reason the species now dominates the planet, there can be problems with overadaptation. In adapting to specific opportunities, such as the discovery of petroleum resources offshore, the individual or community can become so specialized that it adapts only with difficulty to further changes, such as the inevitable exhaustion of the resources. Some anthropologists call this "loss of adaptive flexibility" (Bateson, 1972; Slobodkin and Rapoport, 1974; Rappaport, 1977, 1979) and sociologists call it "overadaptation" (Gramling and Freudenburg, 1992; Freudenburg and Gramling, 1992). The problem occurs as over long periods, and in many ways, adaptation uses up existing resources; once the activity declines or ceases, the region becomes less flexible (because some of the resources have been used up in the process of adapting) than they were before. The plight of coastal communities in Louisiana that floated bond issues to build ports to handle OCS development could be illustrative. As the activity declined, the port brought in less revenue and supported fewer jobs, but their bonded indebtedness prevents communities from raising more money for new projects. Similarly, decisions to maximize the benefits of offshore oil for a local economy might well have opportunity costs, excluding alternatives such as fishing or tourism.

The actions commonly undertaken by MMS that can affect a community range from prelease announcements to long-term patterns of leasing (NRC, 1989a). It is important to note, as the earlier report emphasized, that effects on the human environment—real, empirically verifiable effects—can occur long before the first physical alteration occurs and can continue long after the activity has ceased. This does not mean that developmental effects (those that occur as a result of the physical construction or operation of a project) should be ignored, but rather that the full range of effects, from opportunity-threat impacts to adaptation, must be considered. Because the panel's analysis of the activities that can cause effects and their dispersion in the human environment has not changed much since its earlier presentation (NRC, 1989a), that discussion is paraphrased here.

Description of OCS Activities

The activities associated with OCS oil and gas exploration and drilling can be described as fitting into five stages (for a more detailed discussion, see Appendix C):

- **Prelease activities** include the announcements of the government's intention to lease, the preparation of supporting documents (environmental impact statements; secretarial issue documents), and the lease sale itself. The effects are anticipatory; they occur before there is any physical change to the human, coastal, or marine environment. They include such responses as fear, anger, distrust, uncertainty, and resentment and are amplified as groups and communities organize to prepare for, resist, or block OCS activity through legal, political, or direct action. These responses are effects that can be studied. Social and political conflict also can develop as those who favor development and those who oppose it confront one another. Finally, but still important, are the directly measurable effects that can occur at this stage, including land speculation and the initial pressures on planning and construction of infrastructure.
- **At the exploratory stage,** other effects can begin. Conflicts over the planned use of the sea, for dock space, for housing, and for transportation routes are seen. At this stage, the economic and population growth associated with the project can begin. Finally, with the onset of drilling, there is the possibility of spills.
- **With development,** the need for land-based support reaches its maximum, as do employment and the purchase of goods. At this stage, OCS activities can transform the social and economic environment of the community (Bunker, 1984; Gramling and Freudenburg, 1990).
- **Production,** which is technology-intensive rather than labor-intensive, begins to shift

OCS activities from the vicinity of the field itself to the areas of subsequent processing and use. Local communities experience drops in employment as support activities for drilling decline and as job skills appropriate to and learned for the development phase are less in demand. The potential for spills decreases or increases depending on whether the petroleum is to be transported by pipeline or tanker. Pipelines are safer, but their use can engender new conflicts over the use of space.

- **Termination,** in whole or in part, brings an end to some effects and signals the start of others. Although employment generally falls off as the oil and gas reserves become exhausted, a short-term influx of population can be associated with the process. Some alterations of the social and economic environment associated with an extractive economy are not immediately reversible, or might be reversible only at very high cost. Socioeconomic systems adapt to the extraction of oil and gas, termination can cause new stresses. Residents and capital (or investment) can move out of the area at the termination phase or in the wake of a major spill or accident.

Within a given region, such as the Santa Barbara Channel in California, these stages can occur simultaneously for different leases or groups of leases.

Dimensions of Effects

Determining how an activity might affect the human environment is critical, whatever disciplinary view is adopted. Commonly considered dimensions include the following:

- How likely is the incidence of a given effect? It is often impossible to predict what effects will attend an OCS project. This implies that it is inappropriate to measure losses only in terms of their expected ("average") value. Here the concepts related to who bears the risk, what the public perception of risk is, and how to assess the degree of risk are important, because significant costs can be associated directly with the increased risk. These costs vary from risk aversion, which is relatively straightforward, to the difficult to quantify but important effects of fear, uncertainty, and doubt. Risk bearing, risk perception, and uncertainty are critical components of the public reaction to proposed OCS oil development and they must be accounted for in any measurement of effects on the human environment (Kahneman and Tversky, 1979; NRC, 1989b). Many people perceive the likelihood of oil spills as being greater than it is. In addition, determining "objective" probabilities is itself difficult (Clarke, 1988; Freudenburg, 1988). An adequate assessment of the effects of OCS development projects should, of course, include estimates of the more certain effects of normal operation as well.
- What is the size or severity of a given consequence? This is the most obvious dimension of effects on the human environment. It matters that an activity produces 20 jobs or 500, that a spill is 2,000 barrels or 200,000, that people's jobs or lives are threatened.
- When, where, how long, or how big will a change be? Are the effects continuous or periodic, how long do they last, when do they occur (in winter or summer, during salmon-spawning season, during tourist season)? The spatial dimension is difficult to assess for socioeconomic effects: The ecological effects of an oil spill can be spatially delineated, but the public response can be national or even international. The *Exxon Valdez* spill affected the way the public perceives the activities of oil and gas producers, even though no OCS oil was involved.
- How does one effect add to others? Is there a cumulative effect? Often, effects cannot be predicted simply by adding up the activities that create them. For example, one offshore-support vessel working out of a small harbor might produce a small change; a second might approximately double that (twice the demand for dock space, fuel, drinking water, waste disposal).

But after some increase in the number of vessels, qualitative changes can occur. The need for new docks, new fuel delivery routes, new water sources, additional waste treatment facilities, and other changes can result as the increased demand exceeds the capacity of existing facilities.

- Can the damage be repaired? Some effects can be mitigated: payment can be made for lost wages, wetlands might be restored, taxes can be paid to cover increased local expenses and services. Other impacts cannot be ameliorated: If the physical environment is perceived to be unique, and if human activity or local culture are directly tied to that environment, as in the Florida Keys or in Bristol Bay, Alaska, then the effects also will be difficult or impossible to mitigate.
- How do the effects interact? Each dimension can be considered alone, but all of them must be considered together. Thus, the probability of an event such as a blowout during exploration is low, but its effects could be severe and the possibility of repairing its damage might be slight.

DISTRIBUTION

The effects of activities on the outer continental shelf are distributed unequally to various elements of the human environment (e.g., Wolf, 1983; Dietz, 1987). For example, Gramling (1980) found that white males enjoyed disproportionate employment benefits associated with escalating OCS activities in the northern Gulf of Mexico. Coastal communities are obviously more likely to feel direct effects than are inland communities. Some consequences are distributed across geographic locations, ages, classes, races, and future generations. Intergenerational equity, an important consideration when there is an irretrievable commitment of resources, is important in economics and ethics. In general, the environmental risks of OCS oil production are borne disproportionately by residents, whereas the benefits largely go elsewhere. Harm can be national as well as local, however; cleanup costs and higher seafood prices, for example, can affect a region or the nation. Effects can be beneficial, harmful, or both at the same time; one appropriate way to consider them is according to the distribution of costs and benefits among different segments of the community and the society at large.

The economic effects of OCS development can be different for residents, producers of goods and services, and governments. Residents can experience a general reduction in an area's aesthetic benefits because of the intrusion of development; public health can suffer from increases in air and water pollution; and changes (positive and negative) in the quality and quantity of recreational opportunities (from alterations in recreational fish populations and physical alteration of beaches) can take place. OCS development can change residents' job opportunities, and, to the extent that they are uncomfortable with OCS leasing and its potential effects, residents will experience fear, uncertainty, and doubt.

Producers of goods and services can be affected as well. Commercial fisheries and charter operations can suffer from reductions in fish populations and area preemption and gear loss. Hotels and restaurants can lose revenue if OCS development reduces the general tourist trade. Any losses to primary natural resource industries can lead to reductions in demand for inputs into these industries and in the general level of economic activity. In addition, OCS activity can preclude other development and lead to increased competition for inputs, such as labor or air pollution permits in nonattainment areas.

Federal, state, and local governments also can be affected. The most obvious effect is the federal revenue from lease sales, royalties, and area rent. But state and local governments also can face fiscal changes to the extent that revenues are generated from OCS-related activities or to the extent that local businesses are harmed or helped: Tax revenues can rise or fall depending on which group is involved. State and local governments can face significant costs and pressures related to

planning for and mitigating the effects of OCS oil development because of the increased demand for public services. Finally, other publicly owned natural resources, such as commercial and recreational fisheries, can be affected by OCS development.

PREDICTING THE RESPONSE

Response Functions

Unlike physical systems (Trimmer, 1950), social systems frequently respond to change in nonlinear and discontinuous ways. Because of "social amplification" (Kasperson et al., 1987), public responses can seem quite disproportionate to the events that precipitate them. The public response to the 1969 Santa Barbara, California, oil spill is a case in point. Just as there is no simple one-to-one correspondence between social structure and functions, "there is no simple one-to-one relationship between variations in inputs and outputs" (Emery and Trist, 1972). For example, Holling (1978) points out that "within broad geographical and temporal limits, impacts mediated by social and economic processes need bear no obvious relation to the initial investment. For example, the local environmental impacts of a pipeline project in a developing region can usually be identified and ameliorated. But the induced effect of the invasion of capital and of construction workers on settlements remote from the pipeline can have dramatic social consequences that cause more significant environmental impacts than the pipeline itself."

Response Sequences

Adaptive structures are characterized by ordered sequences of responses that typically unfold in graduated and coordinated patterns (Rappaport, 1979). Initial responses tend to be quickly mobilized and energetically and behaviorally expensive, but easily reversible. Later responses can involve structural change and diminished flexibility. Coordination of responses is usually regulated through a hierarchical organization. Effects at the response stage can take the form of increases in structural complexity and shifts toward centralization in the locus of control. Response sequences can become disordered; interaction effects can impair adaptive capacity. These alterations represent the evolving and emergent states of social conditions and the social systems of the human environment.

Response Rates

Response rates, the temporal distribution of adaptive structures, can be expressed in terms of resource creation and mobilization. "Mobilization is the process by which a group secures collective control over the resources needed for collective action. The major issues, therefore, are in the resources controlled by the group before mobilization, the processes by which the group pools and directs these toward social change, and the extent to which outsiders increase the pool of resources" (Jenkins, 1983).

Applied to movements of institutional change, such as those formed in response to perceived threats to a group's way of life, the basic resource model involves "rational actions oriented towards clearly defined, fixed goals with centralized organizational control over resources and clearly demarcated outcomes that can be evaluated in terms of tangible gains" (Jenkins, 1983). Despite the anticipation of effects, readjustive change tends to lag behind conditions of rapid growth, especially

with regard to the availability and adequacy of infrastructure (Weber and Howell, 1982). The social technology for coping with these "structural strains" appears at the end of the assessment process, which consists of evaluation, mitigation, monitoring, and management.

IMPACT EVALUATION

The response of adaptive systems to changes in their states and structures depends in part on the perception of effects, followed by the attribution of causes and the interpretation of consequences. The evaluation of consequences depends on the criteria of significance and acceptability. In recent years, the evaluation of change has been extensively analyzed in terms of risk, defined here as the probability of harm. In the terminology of risk assessment, the corresponding terms are risk perception, risk attribution, risk evaluation, and risk acceptance. The process by which risk perception and evaluation are transmitted and shared is risk communication. The individual and collective decisions made in response to risk communication make up risk management. This discussion focuses on the evaluative criteria for significance. It also reviews valuation procedures for ranking and weighting preferences, and for designating a preferred alternative to a proposed action.

Evaluative Criteria

The determination of the significance to the community of an effect is a value-added process that requires participation by members of affected and interested groups. Public participation is relevant and important at every step of the assessment (Daneke et al., 1983; Erickson, 1985); it is essential in determining whether an assessed effect is regarded as beneficial, harmful, neutral, or all three in varying combinations over time, space, and affected groups. For example, should a change in the number of hospital beds or lawyers per thousand people be interpreted as desirable, as undesirable, or as having no effect?

Although it is indispensable to the evaluation, the expression of a public preference might not be critical in deciding on a preferred alternative. The power to make such decisions traditionally has resided with public agencies, which derive their legitimacy from representing the public interest. But the concepts of representation (who does the determining?) and the public interest (on what criteria are decisions made?) are not universal; understanding them depends on scientific understanding as well as on the public's understanding of science.

On the technical side, latent "expert versus public" conflicts are implied in the distinctions between "real" and "perceived" risk (Covello, 1983) and between technical risk analysis and public risk evaluation. Risk analysts believe that because they apply such methods as revealed preference and probabilistic risk assessment, their estimates are more accurate and objective than are the evaluations of the public. On the institutional side, disputes occur over evaluative criteria and decision power. Experts too often elevate objective rationality to the highest rank and they too often view the public as harboring irrational fears. Because reason is on the side of the experts, they argue, they or those who employ them should make decisions. Needless to say, such attitudes along with agency bias alienate and antagonize members of the lay public, who are the real experts on their own interests and values (Timmerman, 1984). This is perhaps the most persuasive argument for including members of the public in setting the research agenda for socioeconomic impact studies.

What divides experts and the public is not the value of rationality as such, but the *kind* of rationality used and the social control exercised over it. Experts tend to uphold an instrumental rationality in which people are included among the means to achieving a socially valued goal. On the

other hand, the public tends to rely on what has been called a "coherent" rationality that subordinates impersonal goals to the rule of reasonableness, taking into account the relevant social contexts and values.

Values are included in both types of rationality, but in instrumental rationality people (and collectivities, such as families and communities) are considered mainly as means to an end, whereas in coherent rationality they are considered the end itself, and this gives them an aura of moral inviolability. The difference could be put in terms of efficiency on the side of instrumental rationality and equity on that of coherent rationality. The practical implication is that in the former, technological possibility forms the starting point; in the latter, sociopolitical constraints do. The link with political analysis is forged in Easton's (1979) definition of politics as the "authoritative allocation of values." This emphasis on values is well placed because "How safe is safe enough?" is fundamentally a question of values, not of science (Fischoff et al., 1984).

Valuation Procedures

The issue of science versus politics further impinges on the selection and application of valuation procedures. Many rational methods for ranking and weighting preferences have been proposed, for example, in "multiattribute utility theory" (Keeney and Raiffa, 1976) and in "contingent valuation" (Mitchell and Carson, 1969). One calculus for determining public preference and choice uses a "weighted input" scheme (Krimsky, 1984): Decision units (families and communities) are weighted by the probability of their exposure to risk and its consequences. In light of the preceding, however, it is not surprising that evaluation seems to be more a process of political negotiation (Raiffa, 1982) than of numerical calculation. Given the social and political realities of impact situations, involving multiple purposes and groups, negotiation is inescapable. The experiences of New Jersey, as described by Hance et al. (1988), and two case studies of social impact assessment in Canada (Erickson, 1985), make clear that the public must be involved in the process and must trust the motivations of the people who assess effects. Those discussions also make clear that no matter how good the analyses are, it is rarely possible to satisfy all parties.

The political dimension is further underscored by the differences in access to and control over intellectual and informational resources by the interested parties. A "fair" bargain implies equality among parties and parity of interests, but the social reality can be quite otherwise. There are limits to political solutions, resting as they do on the preferences of shifting coalitions and on the indefinite relation of information and decision (see below). One year's political solution can be the next year's political catastrophe.

The rational calculation of socioeconomic preferences incurs difficulties of its own regarding the valuation of nonmarketables, which often are held to be inherently qualitative, subjective, or intangible. The invocation of higher principles mentioned previously is partly responsible for this impression in the evaluation of the legitimacy of computational techniques that can place one party's vital interests at risk, as happens, for example, in "negotiating a way of life" (La Rusic et al., 1979). In fact, the value of a life or a species is rationally and routinely calculable on narrow technical grounds. Rather, the point is that in some value contexts such calculation violates moral sensibility and autonomy. Issues surrounding these situations and their unique features are declared non-negotiable. No better demonstration need be asked of the partiality of objectivity and the non-neutrality of information.

Preferred Alternatives

The evaluation of effects is one step in the process of designating a preferred alternative. How the decision is reached can go far beyond the information provided about effects, however. Although the legal requirement for impact assessment leads participants to expect that the process itself will establish grounds for a decision, the result could rest on factors outside the assessment. Legislative authorizations such as the National Environmental Policy Act of 1969 (42 U.S.C. §§4321-4347) stipulate that public officials consider impact information in reaching their decisions. Nevertheless, the relationship between the information they consider and the decisions they reach is not straightforward and the process itself lacks transparency.

These circumstances again point to a paradigm clash between instrumental and coherent rationality. Conflict resolution in this case requires an integration of facts and values, of science and politics. By rational analysis, impact evaluation can determine the balance of benefits and harm that can accrue to various affected groups as a consequence of a proposed action. Whether the public will judge those effects to be beneficial and acceptable to individuals, families, or communities depends further on provisions for mitigation.

MITIGATION

Mitigation is based on the identification, projection, and evaluation of effects that could be associated with a proposed action. The aim of impact mitigation is to bring the estimated values of impact variables to within an acceptable range.

The basic requirement of impact mitigation is that the public likely to be affected by an action will accept the likelihood of any benefit or harm the action would bring. Any viable mitigation strategy must therefore seek to create conditions that are conducive to public acceptance. Foremost among these is active public and community involvement in the assessment process itself. Such involvement raises public expectations of respectful and equal treatment, however. The condition of meaningful participation is genuine sharing of decision power between proponents of a proposed action and those who will bear its effects.

For there to be a process of participation there must be a *basis* for participation. Laying the foundation can entail the empowerment of persons involved in negotiating mitigation measures. It should not be assumed that elected officials adequately represent their constituents' interests, or that constituents *know* what the interests are with certainty and finality. Moreover, broadening the basis of participation will affect the distribution and dispensation of power. Although that is a political reality in many cases, power sharing as a mitigation strategy far exceeds the current formal authority of public agencies. The conditions of meaningful participation lie outside agency control and rest instead with the larger political system.

There is another, principled reason that autonomous power is a condition for risk acceptance. It goes beyond the interplay of special interests to the core of common values that can be said to constitute the public interest, the notions of justice as fairness (Rawls, 1971) and of respect for the rights and interests of potentially affected groups. This is especially the case where imbalances are perceived between the benefits and harms of a proposed action, such as the construction of a hazardous-waste facility. Timmerman (1984) points out that

> one area or community is being asked to take on what is presented to them as a reasonable burden for the sake of a larger social and political community of which they are a part. That is, an appeal is being made on one level to people's sense of

> community spirit, above and beyond any proposed package of additional benefits or compensation.
>
> The only way for this appeal to catch on…is to operate within the moral framework it invokes. That means… treating a community as an end in itself, rather than as a means to some proposed goal, such as siting a facility. If a community is to be asked to act on behalf of the larger, political entity, that entity is obliged to consider its reciprocal obligations to respect the worth of that community operating as a community, by being seen to act in its best interests as well.

As a practical matter, there is a voluntary dimension to risk acceptance (Slovic, 1987) and to an attribution of control associated with it. It appears that community control is a potent factor in risk acceptance that extends the range of mitigation measures available.

Mitigation Measures

The range of mitigation measures can be viewed as consisting of enhancing effects, avoiding them, or mitigating and compensating for them. To enhance an effect is to maximize its benefits; avoidance minimizes harm. Unavoidable effects can be mitigated by economic incentives (compensation) or noneconomic ones. Mitigation is generally applied in anticipation of an effect; compensation is made after the effect occurs.

Economic incentives range from direct payments (impact fees, subsidies to community facilities and for services, prepayment of taxes) to payments such as for the purchase of land to compensate for wildlife habit destruction. In between are the creation of insurance funds, for example to guarantee property values, and policies that provide for hiring local workers and purchasing goods in the community. Noneconomic incentives range from granting access to information to allowing community supervision of proposed activities. They include access to information about site development and management, providing funds for hiring independent experts, allowing communities to monitor site operations, giving communities representation on facility governing boards, and awarding local authority to shut down a facility when treatment or management deficiencies are found. Together, these items form a package of control measures perceived to enhance risk acceptability far beyond that achievable through monetary incentives alone. Survey research findings from Wisconsin, Pennsylvania, and Tennessee confirm the effectiveness of these measures for site selection and regulation.

These measures can be specifically and selectively applied at policy, program, and project levels of assessment. Policy adjustment can alter the mix and balance of planning goals and objectives in accordance with public preference. Program alterations can similarly revise planning guidelines and design specifications. Project modifications can tailor operating procedures and activities to suit local conditions. In all cases, proposed mitigation measures must be subjected to the same kind of assessment that the proposed action receives, for example, by means of sensitivity analysis. To validate predictions of the measures' effectiveness in practice involves one more step: monitoring the effects of an action.

MONITORING

Mitigation should be coupled not only with predictions of effects, which often are imprecise (NRC, 1986; Culhane et al., 1987), but also with their occurrence. Impact monitoring provides the basis for comparison between the two. As in the case of mitigation, the very same impact variables identified and analyzed in the assessment steps form the monitoring system's structure. The kinds of

monitoring likewise follow the pattern of assessment (Carley and Bustelo, 1984). The goal of monitoring is to measure the effects linked to the proposed action in interaction with the human environment and to communicate the results to decision makers and the public for their use in deciding how to manage or mitigate those effects. Monitoring data also are used to inform future decisions about the effect of proposed projects and to evaluate the effectiveness of policies.

A generic problem of the impact assessment process mandated by the National Environmental Policy Act of 1969 has been the lack of sufficient monitoring in all phases of project development. Because of geological, technical, social, and political uncertainties, roughly proportional to project scale, development plans are subjected to frequent and abrupt modification; review of a proposed action at one point in the process does not accurately describe the actual or expected effects of a project. What you see once is distinctly *not* necessarily what you get later. Under these circumstances it is difficult to assign responsibility or enforce accountability for project development.

One corrective action would be to repeat assessment later in the development of a project (Clark et al., 1983). Far better would be to require a continuous process of assessment by instituting monitoring procedures like those employed by the Tri-County Socioeconomic Monitoring Program (1990) to assess current and cumulative effects on project expenditures, population growth, and public services. In addition to offering a direct benefit in the form of community involvement, such a program is instrumental in the effective assertion of community control.

Types of Monitoring

Socioeconomic monitoring can be categorized as shown in Table 3-1.

Technology monitoring includes following trends in technology development and project-specific applications. Implementation monitoring tracks the course of project development, including institutional and managerial factors. Environmental and ecological systems monitoring traces indirect socioeconomic effects through media and biota. Trend impact monitoring compares actual with projected changes in social conditions and systems, compiled for the "future without" the proposed action in quality-of-life indices.

TABLE 3-1 Socioeconomic Impact Monitoring

Proposed action	Technology monitoring; Implementation monitoring; Environmental monitoring
Human environment	Trend monitoring; Quality-of-life monitoring
Response	Issues tracking; Mitigation monitoring; Compliance monitoring

Direct effects on the human environment are measured by response monitoring of social concerns generic to the state of society and specific to the proposed action (this is also called "issues tracking"). Mitigation monitoring gauges the relative effectiveness of established mitigation measures, adjusting for predicted changes in social conditions and trends; compliance monitoring tests the effectiveness of regulatory measures conditioning the stages of development. The ultimate goal of monitoring is the systematic testing of impact hypotheses formulated for use in policy analysis and impact management, a process begun under the auspices of evaluation research.

Evaluation Research

Unlike impact evaluation, which aims at judging the significance of predictions of effects, evaluation research

> (1) assesses the *effectiveness* of an ongoing program in achieving its objectives, (2) relies on the principles of research design to distinguish a program's effects from those of other forces working in a situation, and (3) aims at program improvement through a modification of current operations.
>
> Evaluation's function is to provide feedback from results to decisions …Evaluation findings can be used to modify current operations and to plan future programs and policies. It provides information for the incremental upgrading of a program, or groups of programs with similar objectives (Wholey, 1970; emphasis in original).

Program monitoring of service delivery and quality (Rossi and Freeman, 1989) are equally applicable to impact management roles and responsibilities.

MANAGEMENT

Impact mitigation and monitoring are the chief instruments of impact management (Halstead et al., 1984); essentially, what there is to management are the mitigation and monitoring plans and procedures formulated in the preceding steps. The Tri-County Socioeconomic Monitoring Program in Santa Barbara County, California, is an exemplar of such efforts (see also Leistritz, 1985). Their structure can be derived from application of the analytical framework described in this section. Their content will vary according to the specific impact situation, e.g., growth management in energy resource communities (Reiff, 1976; Summers and Selvik, 1982; Weber and Howell, 1982; Detomasi and Gartrell, 1984).

The management role can be viewed as broadly as the impact assessment process itself, however, beginning with the initial scoping phase and continuing throughout the series of steps traced in the analytical framework. Counterpart of these analytical operations are the social processes by which they are planned and performed, and the involvement of various interested parties and affected groups. Social process development is therefore a continuous management task that extends to local and larger communities as well as to the professional community of impact assessment practitioners.

QUESTIONS AND ISSUES

The panel cannot detail every aspect of the information needed for a socioeconomics studies program. However, in its assessment of information for three lease sales off California and Florida (NRC, 1989a), it outlined socioeconomic information needs. That outline (with minor changes) follows:

What Information is Needed

Assessment of the potential socioeconomic effects of OCS activity differs from the assessment of biological and physical effects in that significant socioeconomic effects can occur *before* a lease sale. On the other hand, socioeconomic impact assessment is similar to the assessment of physical and biological effects in that additional site-specific information should be obtained before decisions are made about development and production.

For all stages, information on the human environment is needed. What are the crucial aspects of people's lives that they perceive to be at risk? At the prelease stage, information is needed on the first two stages of the leasing process: prelease and exploration activities. Basic information on the distribution and dimensions of effects also is needed.

A variety of sources of information are available concerning the social and economic activities of people in the vicinity of proposed lease sales. These range from national census data to records collected and maintained at the local level. Because the data usually have been collected for purposes other than to assess the effects of OCS activities, they have three shortcomings for impact assessment. First, they are almost always collected by a political, economic, or socially delimited geographic unit (state or county government, planning district, or national park), and OCS activities and human activities do not conform to these boundaries. Second, the data are almost always collected on a convenience basis; they are collected when people engage in activities that can be recorded (they take jobs, pay admission to a state park, pay for a motel room, vote, pay taxes, catch and commercially sell fish, buy a license for a variety of activities, or cross a traffic counter on a state highway). Third, because the data are aggregated at different levels, it is difficult to link them: There is no way to know whether the person who visits a state park also pays for a motel room. Because the data are aggregate and are based on geography and on convenience, they can be used only in a limited way to assess the effects of OCS activities on the human environment. Socioeconomic data not collected specifically to assess the potential effects of OCS oil and gas activities must be evaluated carefully to determine how useful they are.

A major impediment to assessing the effects of OCS activities on the human environment appears to be the Office of Management and Budget (OMB) approval process for surveys performed with federal funds (OMB Circular A-21 concerning compliance with the Paperwork Reduction Act). OMB approval is required before members of the public can be interviewed in significant numbers. It is clear that MMS needs survey information and that an accommodation with the OMB approval process must be reached. In addition, any survey will require careful design to capture the specific local features that define the economy, sociology, and quality of life of a particular region.

Another obstacle is funding. The budget for the Environmental Studies Program has been declining recently (MMS, 1987a), even as the need for socioeconomic information is increasingly recognized. Furthermore, socioeconomic studies have received only a small share of the available funding. This is reflected in the near total absence of primary socioeconomic data.

In addition to information needed during the prelease and exploration stages, information should be gathered during development, production, and termination. It should be possible to obtain more site-specific information after exploration; this heightens the need to collect data specifically related to the potential effects of the proposed activity. At this stage, it is important to know whether the assessment considers all five stages of the OCS development process (prelease through termination) and whether it covers the dimensions of the potential effects adequately. It is possible and crucial to know at this stage whether the information permits identification of the relevant social groups and systems that will be affected.

The panel offers below a series of questions that amplify the above discussion from the earlier report; they are intended only as a guide for consideration. The list is not exhaustive, and it cannot apply to every time and place. Other questions are implicit in more detailed discussions of this and other chapters and the appendices.

Effects on Communities

What are the potential effects of the proposed action on employment, local industries,

infrastructure (medical and education facilities, roads), cultural and religious traditions, lifestyle options, tourism, tax bases, water supplies, community and local governments, and other organizations?

What is the public's attitude toward and perceptions of the proposed development? What are the major concerns and what are perceived as the major benefits?

Are the concerns and legal rights of privileged and special groups (such as Native Americans) treated in the studies?

Is there evidence of the assessment of stress-related disorders, including an initial statement of their existence and likelihood and a later effort to collect indices of them?

Effects on Other Local Users of the Ocean and Coastal Zone

Have the effects in the following areas been considered?

- Fishing: commercial, subsistence, and recreational.
- National security (military): harbor facilities, access to exercise areas, navigation and overflight losses.
- Marine transportation: changing shipping routes, added risk of collision with offshore platforms.
- Coastal and ocean tourism and recreation: offshore, coastal, and harbors. Pollution, visual effects that reduce recreation experience, increased traffic, competition for harbor and mooring space.
- Other industries in the coastal zone that can compete for scarce resources, such as labor, air emission credits, land, and water.
- Marine aquaculture: preemption of ocean space, pollution, etc.
- Marine protected areas.

Effects on Local and State Governments

Have the following effects been considered?

- The need to redistribute benefits to balance local costs, for example, through revenue sharing, mitigation.
- The need for increases and distortions of administrative staffs to contend with oil activities, including opportunity costs for time spent dealing with oil issues that is no longer available for other pre-oil matters.
- Dependencies created in state revenue bases and cumulative fiscal effects estimated for life of resource.
- Social and political conflicts created, including institutional responses anticipated: citizen initiatives, new forms of government to cope with new demands and conflict, added legal burdens and costs.

Have allowances been made for the relative differences in the ability of local authorities to represent constituent interests and operate with the federal government? (Monroe County in Florida is not the same as Santa Barbara County in California.)

Effects on Science and Local Scientists

Will there be harm to existing offshore, coastal, or harbor study sites?

Will there be archaeological effects of onshore facilities, and need to conduct retrieval and archival work?

Individual Lease Sales

Are estimates of petroleum resources presented in an array from lowest to highest and compared according to likely socioeconomic consequences?

Are likely negative socioeconomic consequences matched to stipulation or mitigation measures to prevent, reduce, or offset them?

Although of short duration and limited geographic scope, are the possible effects of exploration on subsistence activities considered? On recreation and tourism?

Are essential but hard-to-quantify socioeconomic factors incorporated in exploration, development, and production plans or considered at all?

Methods

Do data exist to allow the raising and answering of the above minimal set of important questions? Are they complete, appropriate, and timely? *Complete* means that they provide coverage of the basic set of questions just raised; *appropriate* means they are matched to the local situations; and *timely* means they reflect current realities as well as those prepared for longer term baseline trend studies.

Have significant trends been established in these terms that would allow departures from them to be detected and appraised?

Can data identification and collection wait until after exploration and discovery of resources? Who is responsible for data collection, coordination, synthesis?

Is there a socioeconomic cost-benefit study contained in the environmental impact statement or in its supporting analyses?

To what degree will research priorities be reshaped to meet the mission and operational demands of environmental impact statements and secretarial issue documents or the threat of lawsuits?

Are studies adequately comparative, revealing the unique aspects of each area and comparing them with other unique and common aspects of the same and other areas?

Have surveys and other procedures for describing and analyzing local understanding and opinions been conducted?

Do the studies and analyses adequately consider accidents caused by human error?

Are risk probabilities calculated? Are they plausible?

Are areas of uncertainty identified and described?

Is scientific knowledge adequately integrated into research plans, reports, and decision documents?

To what degree can the studies program adapt to the information gained from research? Have projected effects been compared with observed effects? Have the effects of previous leasing, development, production, and termination been properly studied in the United States and elsewhere and been incorporated into the program? In other words, can the program learn from its and others' experiences?

Are the methods used to analyze the data appropriate and adequate?

Are the models and theories used appropriate and tuned to the specific contexts of interest?

Are positive and negative effects adequately disaggregated?

Are the elements of the analysis integrated?

Are the assumptions explained?

Has there been proper consideration of short-term, long-term, and cumulative effects?

Are there enough MMS personnel in each of the areas? Are they trained and diverse enough to allow these questions to be raised and answered?

To what degree do OMB restrictions prevent or hamper the study of various questions?

Have the studies been submitted for independent scientific review? Are any results of reviews available?

Have the potential effects been considered for each phase of development? If not, has the omission been justified?

Is the study clearly written, so that a lay person could read it?

Is there a summary of major effects (costs, benefits, and consequences)? Are major effects related to relevant groups in the setting?

Minerals Management Service has little expertise outside of Alaska (and some in the Pacific) to address the effects of OCS leasing on the human environment. Nonetheless, the service is coming under increasing pressure to move forward in this direction nationally. As MMS begins to establish a viable social science research program, it would do well first to recognize that the scientific community currently has the tools to assess and monitor the activities as required by the Outer Continental Shelf Lands Act and amendments (43 U.S.C. §§1331-1356, §§1801-1866). Second, members of the public who are potentially affected by OCS activities are expert in some areas of assessment and must be involved in setting the research agenda. Third, the relatively successful program established in Alaska demonstrates that the task is feasible. Finally, avoiding the pitfalls noted above and considering the full complexity of the human environment will require increased investment of human and financial resources, at least in the beginning. Development of a viable socioeconomics research program cannot be achieved overnight, as MMS's scientific committee has noted (W. Freudenburg, pers. comm., University of Wisconsin, 1989).

4

Analysis of the Program

This chapter outlines the socioeconomics component of the Outer Continental Shelf (OCS) Environmental Studies Program, which is a component of the Minerals Management Service (MMS) of the Department of the Interior. The presentation in this chapter will be divided by region because the environmental studies are largely products of the MMS regional offices. The discussion is somewhat uneven because of wide variations both in the number of socioeconomic studies and in the documentation of systematic socioeconomics programs in the different regions. Particular focus is placed on the program in Alaska, because most of the socioeconomic studies have been performed there and because the structure and history of the Alaska program are well documented.

ATLANTIC REGION

The Socioeconomics Panel was unable to identify documentation of a systematic MMS program for identifying and analyzing important socioeconomic issues for study in the Atlantic region. Table 4-1 is a list of studies identified by MMS as socioeconomic.

The Atlantic region socioeconomic studies include collection of baseline information from secondary sources (Research Institute of the Gulf of Maine, 1974); determination of onshore environmental effects of offshore-related facilities (International Research and Technology Corporation, 1976); identification of historically important potential shipwreck sites (Harvard College Institute of Conservation Archaeology, 1979; Science Applications, Inc., 1981); evaluation of the effects of oil spills on commercial fisheries (University of Rhode Island/Applied Science Associates, 1980-1982); quantification of traveler spending and associated state, federal, and local revenues (U.S. Travel Data Center, 1975); an assessment of potential conflicts between the fishing and oil industries (Centaur Associates, Inc., 1981); an evaluation of the technical feasibility of alternative modes of oil and gas transportation (Policy Planning and Evaluation, Inc., 1983); an assessment of effects associated with pipeline construction and operation (Rutgers University, 1983); and conversion of estimates of local expenditures of oil and gas operators to estimates of changes in regional employment and personal income (Kearney, 1991).

Many of these studies address important issues, but they primarily concern natural science or engineering. For example, the Research Institute of the Gulf of Maine (1974) reports what appears to be primarily an inventory of physical and biological resources, but it also includes some secondary data on selected socioeconomic issues. International Research and Technology Corporation (1976) determined the physical and environmental effects of OCS-associated onshore development, but not their socioeconomic implications. The University of Rhode Island/ Applied Science Associates model

TABLE 4-1 Socioeconomic Studies in the Atlantic Region

The Research Institute of the Gulf of Maine 1973-74. A Socio-Economic and Environmental Inventory of the North Atlantic Region Including the Outer Continental Shelf and Adjacent Waters from Sandy Hook, to the Bay of Fundy.
International Research and Technology Corporation, 1975. Environmental Consequences of Onshore Activity in Four New Jersey Coastal Counties Resulting from Offshore Oil Development.
Virginia Institute of Marine Science (VIMS), 1974. A Socioeconomic Environmental Baseline Summary for the South Atlantic Region Between Cape Hatteras, North Carolina, and Cape Canaveral, Florida.
U.S. Travel Data Center, 1975. Travel Economic Impact Model: Final Economic Analyses Methodology; Final Demonstration Project.
International Research and Technology Corporation, 1976. Environmental Consequences of Onshore Economic Activity Resulting from Offshore Oil and Gas Development in New England.
International Research and Technology Corporation, 1978. Environmental Consequences of Onshore Activity Resulting from Offshore Oil and Gas Development in the Mid-Atlantic.
Harvard College Institute of Conservation Archaeology, 1979. Summary and Analysis of Cultural Resource Information on the Continental Shelf from the Bay of Fundy to Cape Hatteras.
Science Applications, Inc., 1981. A Cultural Resource Survey of the Continental Shelf from Cape Hatteras to Key West, 4 Vols.
University of Rhode Island and Applied Science Associates, 1980-82. North Atlantic OCS Area Study of the Economic Cost from Oil Spills to Commercial Fishing.
Centaur Associates, Inc., 1981. Assessment of Space and Use Conflicts Between the Fishing and Oil Industries.
Policy Planning and Evaluation, Inc., 1983. Study of Alternative Modes of Transporting OCS-Produced Oil and Natural Gas.
Rutgers University, 1983. Identification and Assessment of Impacts Associated with the Construction and Operation of Submarine Pipelines on the Mid-Atlantic Outer Continental Shelf.
Walcoff & Associates. 1989. Proceedings of the Third Atlantic Outer Continental Shelf Region Information Transfer Meeting (ITM).
Continental Shelf Associates, Inc., 1990, 1991. Synthesis of Available Biological, Geological, Chemical, Socioeconomic, and Cultural Resource Information for the South Florida Area.
A.T. Kearney, Inc., 1991a. Impacts of Oil and Gas Development on Recreation and Tourism off the Florida Straits.
A.T. Kearney, Inc., 1991b. Impacts of Oil and Gas Development on Recreation and Tourism on the Atlantic Continental Shelf.

Source: Compiled by Socioeconomics Panel from information provided by MMS.

is primarily an analysis of physical fates and biological effects of oil spills that includes the weight and value of lost catch. This is clearly an important study with serious socioeconomic implications, but it is primarily an analysis of physical oceanography and biology, and contains little or no socioeconomic *analysis*. No social scientists were involved in the effort. The Policy Planning and Evaluation, Inc., report (1983) is basically a technical analysis that includes a cost analysis of alternative transportation modes, but ignores the effects of the alternatives on society. Rutgers University (1983) compiled secondary data on physical, biological and socioeconomic systems in the Mid-Atlantic.

Few of the studies carried out socioeconomic analysis or focused solely or even primarily on socioeconomics. Most of the socioeconomic content of these studies is in the form of secondary data. Although important, this does not itself constitute a socioeconomics program, and very little of the effort in the Atlantic region is placed on socioeconomic analysis. Notable exceptions are the studies by Centaur Associates, Inc. (1981), and the U.S. Travel Data Center (1975). The Centaur Associates study identifies and characterizes potential areas of conflict between the fishing and oil industries. It examines the history of various conflicts and uses primary data to examine potential for conflict in 30 ports on the Atlantic coast, the Gulf of Mexico, and in California. The study used a sound approach and carried out a thorough analysis of this important issue. Of course, the information requires frequent revision because conditions in many ports change rapidly.

The U.S. Travel Data Center (1975) used a model to estimate various economic effects on recreational travel, including traveler expenditures, associated tax receipts, secondary employment, and personal income. These are potentially valuable data for putting potential tourist revenues into perspective. However, a thorough economic impact assessment of this issue would go beyond the collection of data to an analysis that relates OCS production to changes in those revenues. Some attempts were made at validating the model, and it was found to be successful in providing data that were in agreement with data from similar studies, but it was not useful for comparison with statewide or countrywide studies, which are the significant areas of analysis for OCS-related issues.

GULF OF MEXICO REGION

The panel found no documentation of a systematic program for identifying and analyzing important socioeconomic issues for study in the Gulf of Mexico region. Table 4-2 is a list of studies identified by MMS as socioeconomic.

Early studies in the Gulf of Mexico were primarily baseline studies (Environmental Consultants, Inc., 1974; Larson et al., 1980; Liebow et al., 1982; Friend et al., 1982; French and Parsons, 1983). These broad characterizations of entire regions were previously criticized by the National Research Council (NRC, 1978) for their lack of focus on scientific issues and for their lack of relevance in determining the effects of OCS activities. Although the baseline studies contain interesting information, their encyclopedic approach virtually ensures that their coverage will be too superficial for meaningful analysis beyond a general characterization of the region. For example, in less than one page, the Friend et al. report (1982) discusses the economic effects of OCS activities on the Port of Mobile. Mobile is a major port with connections to the Intracoastal Waterway and the Tenn-Tom waterway. Notable exceptions to the baseline study approach during the Bureau of Land Management (BLM) era were two Coastal Environments, Inc. (1977, 1986) underwater surveys of potential archaeological sites in the northern Gulf of Mexico; and an analysis by Restrepo et al. (1982) of the economic effects of the *Ixtoc I* well blowout in the Bay of Campeche, Mexico, in 1979, and the *Burma Agate* tanker spill, which resulted from a collision with the freighter *Mimosa* near Galveston, Texas, in 1979.

TABLE 4-2 Socioeconomic Studies in the Gulf of Mexico Region

Environmental Consultants, Inc., 1974. Socioeconomic Inventory and Analysis of the Gulf of Mexico Region.
Coastal Environments, Inc., 1977. Cultural Resources Evaluation of the Northern Gulf of Mexico Continental Shelf.
Larson et al., 1980. Mississippi Deltaic Plain Region Ecological Characterization: A Socioeconomic Study.
Liebow et al., 1982. Texas Barrier Islands Region Ecological Characterization: A Socioeconomic Study.
Restrepo et al., 1982. *IXTOC I* Oil Spill Economic Impact Study.
Friend et al., 1982. Alabama Coastal Region Ecologic Characterization: A Socioeconomic Study.
French and Parsons, 1983. Florida Coastal Ecological Characterization: A Socioeconomic Study of the Northwestern Region.
Resource Economics & Management Analysis, Inc., 1987. Analysis of Indicators for Socioeconomic Impacts Due to OCS Oil and Gas Activities in the Gulf of Mexico, Year II.
Centaur Associates, Inc., 1986. Indicators of the Direct Economic Impacts Due to Oil and Gas Development in the Gulf of Mexico.
Coastal Environments, Inc., 1986. Archeological Investigations on the Outer Continental Shelf: A Study Within the Sabine River Valley Offshore Lousiana and Texas.
Texas A&M Research Foundation, 1989. Historic Shipwrecks and Magnetic Anomalies of the Northern Gulf of Mexico: Reevaluation of the Archeological Resource Management Zone 1.

Source: Compiled by the Socioeconomics Panel from information provided by MMS.

Since the creation of MMS in 1981, there have been two primary studies completed in the Gulf Region (Centaur Associates, Inc., 1986; Texas A&M Research Foundation, 1989). The Centaur Associates study was an extensive effort conducted in cooperation with the Offshore Operators Committee to collect data about offshore workers in the Gulf of Mexico in 1984. The data were used to create an input-output model for the coastal northern Gulf. It is unclear how this model has been used, if at all. Socioeconomic analyses outside of MMS have been performed, with the data used to compile the input-output model. For example, Gramling (1989) uses the data to demonstrate that about $77 million flowed out of the state of Louisiana in 1984 in the form of wages and salaries paid to offshore workers. The Texas A&M Research Foundation study (1989) is an archaeological evaluation concentrating on historic shipwrecks.

PACIFIC REGION

The panel was unable to identify documentation of a systematic program for identifying and

analyzing important socioeconomic issues for study in the Pacific region. Table 4-3 is a list of studies in the Pacific region identified by MMS as socioeconomic.

The earliest MMS socioeconomic study in the Pacific Region is an archaeological survey and collection of maps (Science Applications, Inc., 1978). Two other studies include modeling targeted toward particular lease sales (Blayney-Dyett, 1981; BLM, 1981) and an effort to inventory coastal recreation sites (Granville Corporation, 1981). Other studies focus on the issues of mitigation of sea-floor conflicts between pipelines and trawl fisheries in California (Centaur Associates, Inc., 1984a); the cumulative effects of oil and gas development in the Santa Barbara Channel (Centaur Associates, Inc., 1984b); information about OCS oil activities and their direct effects (Centaur Associates, Inc./ECOS Management Criteria, Inc., 1985); and the effects of OCS development on recreation (Dornbusch and Co., 1987a, b). Later efforts gathered socioeconomic baseline data from secondary sources (Kearney/Centaur, 1987a,b).

Several of the socioeconomics studies in the Pacific Region have attempted to go beyond secondary data collection and to apply socioeconomic analysis. However, the modeling efforts are based on critical assumptions that are not easily justified, nor are they supported by data. Many of these studies are small-scale computer analyses, rather than in-depth studies based on primary data collection and actual experience. As discussed in an earlier review (NRC, 1989a), the modeling efforts have not been adequately integrated with field observations, or adequately calibrated and verified.

In addition, some of these analyses have methodological difficulties, as noted previously (NRC, 1989a). The Dornbusch (1987) study contains an inventory of California's aesthetic resources, but no research questionnaire was used. Landscape architects developed aesthetic ratings to evaluate effects, but did not survey recreational users. The study also used a travel-cost procedure for California. Unfortunately, the contractor combined it with another procedure, a gravity model, whose underlying foundation contradicts the travel-cost procedure. The results are therefore logically inconsistent. The use of the gravity model driving the tourism analyses also is flawed. Gravity models (described on pp. IV-67-69 in the draft environmental impact statement for Lease Sale 91; MMS, 1987d) have a long history in the social sciences, but their basic limitations (although understood) are not usually appreciated (Stewart, 1948). Among other limitations, one direct application to the draft environmental impact statement for northern California (MMS, 1987d) is that "the gravity model is designed to account for the behavior of large groups of people" (Huff, 1965). This means that only large spatial units (100 km2), trafficked by large numbers of people (100,000 or more), are amenable to a gravity treatment. Also, in common use, spatial units are treated contiguously, not in isolation or as being disconnected. None of these conditions holds for tourism in northern California.

The results regarding offshore platforms and beach use were reported to be "conflicting and erratic" (Dornbusch & Co., 1987). The presence of oil rigs was found to be associated with increases in beach use in some cases and with decreases in others. The contractor rejected the results in the detailed discussion in the third volume and concluded in the executive summary that there would be no effect from oil rigs. The environmental impact statement for Sale 91 drew on the contractor's conclusion in the executive summary to conclude that oil platforms have no effect on tourism. This is inconsistent with the detailed findings of the Dornbusch & Co. study.

There have been several attempts to apply socioeconomic analysis to OCS activity in the Pacific region. As such, the program in the Pacific has gone beyond those in the Atlantic and the Gulf of Mexico. However, modeling efforts in the Pacific Region are small-scale computer analyses, rather than in-depth studies with primary data. Insufficient efforts have been made to incorporate actual primary data to calibrate or verify the models. In addition, many of the studies have serious methodological difficulties.

TABLE 4-3 Socioeconomics Studies in the Pacific Region

Southern California Ocean Studies Consortium of the California State University of Colleges, 1974. A Summary of Knowledge of the Southern California Coastal Zone and Offshore Areas: Social and Economic Areas.

Science Applications, Inc., 1978. Archaeological Literature Survey and Sensitivity Zone Mapping of the California Bight Area.

Wambem and Osborn, 1980. Potential Onshore Impacts in the San Francisco Bay Area on the Future Distribution of Population, Housing, and Jobs.

Wambem and Osborn, 1980. Land Use and Economic Impacts in the San Francisco Bay Area Region.

Blayney-Dyett, 1981. The Impacts of Proposed OCS Lease Sale No. 68 on Public Services in Santa Barbara and Ventura Counties.

Granville Corporation, 1981. Inventory and Evaluation of California Coastal Recreation and Aesthetic Resources.

Department of the Interior (DOI), 1981. Economic Impacts of Proposed OCS Sale No. 68 Offshore Southern California.

Centaur Associates, Inc., 1984a. Mitigation of Sea Floor Conflicts Between Oil and Gas Pipelines and Commercial Trawl Fisheries on the California Outer Continental Shelf.

Centaur Associates, Inc., 1984b. Cumulative Socioeconomic Impacts of Oil and Gas Development in the Santa Barbara Channel Region: A Case Study.

Fernandez, J.M., 1984a. Economic Impacts of Proposed Southern California Lease Offering.

Fernandez, J.M., 1984b. Economic Impacts of Proposed OCS Lease Sale No. 73.

Yamasaki, R.M., 1984. Oil and Gas Transportation Scenario for the Proposed Southern California Lease Offerings.

Centaur Associates, Inc./Ecos Management Criteria, Inc., 1985. Facilities Related to Outer Continental Shelf Oil and Gas Development Offshore California: A Factbook.

ECOS Management Criteria, Inc., 1985. Economic and Demographic Profile of San Luis Obispo County, California.

Dornbusch & Co., 1987a. Comments on OCS Impacts of California Coastal Recreation.

Dornbusch & Co., 1987b. Impacts of Outer Continental Shelf Development on Recreation and Tourism.

Kearney/Centaur, 1987a. Baseline Socioeconomic Profiles of Coastal Counties in the Southern California Planning Area.

Kearney/Centaur, 1987b. Socioeconomic Profiles of Coastal Counties in the Northern California Planning Area.

PS Associates, 1987. Archaeological Resource Study: Morro Bay to the Mexican Border.

Central Washington University, 1990. Potential Effects of OCS Oil and Gas Activities on Oregon and Washington Indian Tribes: Description of Overall Legal Environment and Legal Status of 16 Specified Tribes.

MBC Applied Environmental Sciences, 1991. Proceedings of the Sixth Pacific Outer Continental Shelf Region Information Transfer Meeting (ITM).

Wooley and Molotch, 1991. Southern California Educational Initiative Socioeconomics Workshop.

Source: Compiled by the Socioeconomics Panel from information provided by MMS.

ALASKA REGION

The Alaska Socioeconomics Study Program (SESP) is an extensive, substantive program of more than 159 individual studies (Appendix D). Rather than providing a discussion of individual studies, this section provides a brief summary of the structure of the program, discusses broad coverage of studies, and discusses some individual studies as examples. The Alaska North Slope region, primarily the Beaufort Sea area, is used for purposes of illustration.

The impetus for the Alaskan SESP was a request by the state of Alaska to the Department of the Interior to develop a special program for socioeconomics, in recognition of the uniqueness of Alaskan cultures. This resulted in a request by Bureau of Land Management to the University of Alaska Sea Grant Program for an integrated, comprehensive planning document for Alaska socioeconomics research. The planning document was developed through a three-day workshop with participants from federal and state agencies, universities, and industry (University of Alaska Sea Grant Program, 1975) and was modified following a public review and presentation at a public conference.

The Sea Grant Program document suggests a structure for a research program and describes its 13 tasks (Table 4-4). These proposed tasks include setting alternative development scenarios; assessing technology to determine facilities likely to be associated with each level of development; examining and learning from the experience of OCS-related socioeconomic effects elsewhere; assessing a variety of socioeconomic effects associated with the various levels of development; and assessing the potential for current or emerging institutions to control and mitigate effects.

The Alaska SESP grew out of this early proposal. Its structure is based on three general components—baseline studies, development scenarios, and impact assessments (Banks, 1986)—which include many of the proposed research tasks. Baseline studies elucidate the nature and status of the human environment and predict changes in that environment in the absence of OCS activity. This provides a basis against which effects can be measured and evaluated. The available baseline studies appear to be carefully conceived and administered descriptions of a broad range of social, economic, and cultural facets of native communities in rural Alaska. The studies' observations of the

TABLE 4-4 Research Tasks Identified in the Alaska Sea Grant Planning Document

Adoption of technology models. Purpose: To determine the facilities that are likely to be associated with OCS development.
Physical environmental analysis. Purpose: To provide an inventory of physical environments, both natural and anthropogenic, that are likely to be affected by OCS activity and to identify resulting changes.
Social and cultural impact analysis. Purpose: To assess existing cultural, social, economic, religious, and political aspects of Alaskan communities and to identify and assess potential effects of OCS development.
Education and community service delivery systems in OCS development regions, local impact areas, and communities. Purpose: To assess the ability of existing community services to meet new or increased demands associated with OCS development.
Social stress and mental health in communities potentially affected by OCS development. Purpose: To identify conditions associated with OCS development that contribute to mental health problems in the communities and to determine the relationship between the two.
Regional economic growth models. Purpose: To review, modify and update existing statewide and regional economic models to identify financial consequences of alternative OCS development scenarios.
Local economy—the economics of the mixed economy. Purpose: To project economic evolution of the mixed market and subsistence economies in areas affected by OCS development.
External economic effects of OCS development. Purpose: To identify and measure the external costs and benefits not directly accounted for in other research tasks.
Demographic models. Purpose: To review, modify, and update existing demographic models to provide regional and community demographic profiles.
Lease sale area development scenarios. Purpose: To develop four alternative scenarios for OCS development for each of the proposed OCS areas.
OCS development social-economic impact and consequences identification. Purpose: Use lease sale area development scenarios and the analytical models developed in other research tasks to identify social and economic effects resulting from OCS development.
Political and management institutions—ability to assess and alter effects. Purpose: To analyze existing political and managerial institutions, to indicate emerging institutions, and to evaluate the institutions' abilities to mitigate harm from OCS development.
Comparative case studies. Purpose: To compile information on social and economic consequences of past petroleum development and to relate these experiences to Alaskan OCS development.

Source: University of Alaska Sea Grant Program, 1975.

consequences of contact between native communities and modern industrial society provide an idea of the alterations in culture that could result from OCS activity.

Table 4-5 is a list of some baseline studies of Alaska's North Slope, focusing mainly on the Beaufort Sea planning area. The studies describe general demographic, social, economic, and cultural facets of native Alaskan communities; the current condition of transportation systems; subsistence resource uses; and the availability of water and other natural resources.

TABLE 4-5 Examples of Baseline Studies for Alaska's North Slope

Report Number	*Author(s), Date, Title*
SR 1	LGL Ecological Research Associates, August 1984. The Barrow Arch Environment and Possible Consequences of Planned Offshore Oil and Gas Development.
TR 2	Peat, Marwick, Mitchell & Co., URSA, Crittenden, Cassetta, Cannon/Hellmuth, Obata & Kassabaum, Inc. and Dames and Moore, April 1977. Alaska OCS Socioeconomic Studies Program Task Report: Literature Review.
TR 5	Crittenden, Cassetta, Cannon/Hellmuth, Obata and Kassabaum, Inc., December 1977. Baseline Studies of the Physical and Manmade Environment: The Beaufort Sea Region.
TR 9	Worl Associates, June, 1978. Beaufort Sea Region Sociocultural Systems.
TR 22	Worl Associates, April 1978. Assessment of Change in the North Slope Beaufort Sea Region Sociocultural Systems.
TR 64	Worl Associates, November 1981. Beaufort Sea Sociocultural Systems Update Analyses.
TR 65	Peter Eakland and Associates, December, 1981. Transportation Baseline Update and Forecast of Conditions Without the Planned Lease Sale, Beaufort Sea.
TR 85	University of Alaska Institute of Social and Economic Research, September 1983. A Description of the Socioeconomics of the North Slope Borough.
TR 96	Research Foundation of State University of New York, January 1984. Nuiqsut Case Study. Final Report.
TR 101	Alaska Consultants, Inc. and Clyde S. Courtnage and Stephen Braund & Associates, January 1984. Barrow Arch Socioeconomic and Sociocultural Description.
TR 117	Chilkat Institute, September 1985. Monitoring Methodology and Analysis of North Slope Institutional Response and Change, 1979-1983.
TR 120	University of Alaska Institute of Social and Economic Research, June 1986. Economic and Demographic Systems of the North Slope Borough: Beaufort Sea Lease Sale 97 and Chukchi Sea Lease Sale 109. Vol I. Description and Projections; Vol. II, Data Appendices.
TR 125	Chilkat Institute, November, 1986. Barrow: A Decade of Modernization (The Barrow Case Study).
TR 129	LGL Ecological Research Associates, July 1987. Subsistence Fisheries at Coastal Villages in the Alaskan Arctic, 1970-1986.
TR 133	Stephen R. Braund & Associates, December 1988. North Slope Subsistence Study: Barrow, 1987.
TR 137	Kevin Waring and Associates, September 1988. A Demographic and Employment Analysis of Selected Alaska Rural Communities, Vol. I.
TR 139	Impact Assessment, Inc., November 1989. Point Lay Case Study.
TR 140	Impact Assessment, Inc., November 1989. Point Lay Biographies.

[TR, technical report; SR, special report.]
Source: Compiled by the Socioeconomics Panel from information provided by MMS.

Development scenarios describe alternative levels of various OCS-related activities, onshore and offshore, to provide a range of expected activities, including the location, timing, and amount of OCS exploration, development, and production. Technology-based studies are used to predict the location, size, and timing of associated onshore and offshore activities. Development scenarios are meant to be based on a reasonable range of technological, economic, and geographic options so that a wide range of development effects can be considered. Technological options include alternative means for transporting oil. Alternative economic conditions would include various assumptions concerning oil prices, investment costs, tax status, and transportation costs. Geographic options would include the possible locations of resources and alternative locations for facilities. Table 4-6 is a list of sample development scenarios for the North Slope.

TABLE 4-6 Examples of Development Scenario Studies for Alaska's North Slope

Report Number	*Author(s), Date, Title*
TR 6	Dames and Moore, April 1978. Beaufort Sea Petroleum Development Scenarios for the State-Federal and Federal Outer Continental Shelf.
TR 65	Peter Eakland and Associates, November 1981. Transportation Baseline Update and Forecast of Conditions Without the Planned Lease Sale, Beaufort Sea (71).
TR 112	Han-Padron Associates, 1985. Beaufort Sea Petroleum Technology Assessment.

[TR, technical report.]
Source: Compiled by the Socioeconomics Panel from information provided by MMS.

Impact assessment studies project the positive and negative consequences of OCS development for the human environment and review various scenarios, including a "no-development" scenario. This information is used to identify the effects of OCS development, to determine the desirability of OCS development given these effects, and to provide information that can be used to help plan for and manage socioeconomic effects. The impact assessment studies are conducted for communities, regions within the state, and for the state as a whole.

Within the Alaska SESP, effects on the human environment are broadly defined to include socioeconomic, sociocultural, and natural-resource effects. The first category includes changes in population, demographics, and employment; fiscal effects; effects on infrastructure; and effects on regional transportation systems. Sociocultural effects include those on subsistence, cultural values, politics, interethnic relationships, public health, and family relationships. Natural-resource effects include changes in water resources, mineral resources, fish and wildlife, and waste discharges.

Table 4-7 is a list of impact assessment studies, classified in several nonexclusive categories. Methodological studies develop methods or models for monitoring and assessing the effects that can accompany development. As an example, Technical Report 77 (TR 77), "Social Indicators of OCS Impact Monitoring," develops techniques to provide quantitative measures of social change and welfare.

Descriptive or case studies examine effects that have occurred in some other context than OCS activity. These studies are particularly important. TR 7, "A Case Study of Copper Center, Alaska," is an in-depth description of the native Alaskan community of Copper Center during construction of the Trans-Alaska Pipeline. The author, an anthropologist who lived in the community

TABLE 4-7 Examples of Impact Analysis Studies for Alaska's North Slope

Report Number	*Author(s), Date, Title*
Methodological	
SR 4	University of Alaska Institute of Social and Economic Research, 1980. OCS Studies Program: Small Community Population Impact Model.
TR 15	Cultural Dynamics, August 1978. Historical Indicators of Native Alaskan Culture Change.
TR 24	University of Alaska Institute of Social and Economic Research, June 1979. Design of a Population Distribution Model.
TR 26	University of Alaska Institute of Social and Economic Research, April 1979. Developing Predictive Indicators of Community and Population Change.
TR 27	Harman, O'Donnell & Henninger Associates, Inc. and Merlyn J. Paulson, Inc., March 1979. OCS Visual Resource Management Methodology Study.
TR 76	Louis Berger and Associates, Inc., December 1982. Forecasting Enclave Development Alternatives and Their Related Impacts on Alaskan Coastal Communities as a Result of OCS Development.
TR 77	Louis Berger and Associates, Inc., May 1983. Social Indicators for OCS Impact Monitoring.
TR 113	University of Alaska Institute of Social and Economic Research, October 1984. Sensitivity of Rural Alaska Model (RAM) Projections to Key Assumptions.
TR 116	Stephen R. Braund & Associates, December 1985. A Social Indicators System for OCS Impact Monitoring.
TR 117	Chilkat Institute, September 1985. Monitoring Methodology and Analysis of North Slope Institutional Response and Change, 1979-1983.
Case Studies/Descriptive	
TR 4	Crittenden, Cassetta, Cannon/Hellmuth, Obata & Kassabaum, Inc., February 1978. Prudhoe Bay Case Study.
TR 7	Peat, Marwick, Mitchell & Co., January 1979. A Case Study of Copper Center, Alaska.
TR 16	University of Alaska Institute of Social and Economic Research, August 1978. Governance Study in the Beaufort Sea Region: Petroleum Development and the North Slope Borough.
SNPTR 28	Habitat North, Inc., April 1979. Socioeconomic Impact of Selected Foreign OCS Development.
TR 64	Worl Associates, November 1981. Beaufort Sea Sociocultural Systems Update Analyses.
TR 96	Research Foundation of State University of New York, January 1984. Nuiqsut Case Study. Final Report.
TR 107	Kevin Waring Associates, Glenn Lundell and Associates, and Fison and Associates, January 1985. Monitoring Oil Exploration Activities in the Beaufort Sea.
TR 119	University of Alaska Institute of Social and Economic Research, March 1986. Cultural Resource Compendium.
TR 125	Chilkat Institute, November 1986. Barrow: A Decade of Modernization (The Barrow Case Study).
Impact Forecast	
SR 1	University of Alaska Institute of Social and Economic Research, July 1979. Statewide Impacts of OCS Petroleum Development in Alaska.
SR 5	Maynard and Partch, Dames & Moore, and Stephen Braund and Associates, February 1985. Review of Cumulative Impact Assessment and North Slope Borough Development Projects.
SR 7	Kevin Waring Associates. 1988. Regional and Village Corporation Employment Profiles.

TR 18	University of Alaska Institute of Social and Economic Research, June 1978. Beaufort Sea Petroleum Development Scenarios: Economic and Demographic Impacts.
TR 19	Alaska Consultants, Inc., August 1978. Beaufort Sea Petroleum Development Scenarios: Man- Made Environmental Impacts.
TR 20	Dennis Dooley and Associates, August 1978. Beaufort Sea Petroleum Development Scenarios: Transportation Impacts.
TR 21	Dames and Moore, June 1978. Beaufort Sea Development Scenarios: Natural Physical Environment Impacts.
TR 22	Worl Associates, April 1978. Assessment of Change in the North Slope, Beaufort Sea Region Sociocultural Systems.
TR 23	James Lindsay & Associates, December 1978. Beaufort Sea Petroleum Development Scenarios: Summary of Socioeconomic Impacts.
TR 51	Alaska Sea Grant Program, University of Alaska. 1980. Western Alaska and Bering-Norton Petroleum Development Scenarios: Commercial Fishing Industry Analysis
TR 62	University of Alaska Institute of Social and Economic Research, August 1981. Statewide and Regional Economic and Demographic Systems, Beaufort Sea (71) Impact Analysis.
TR 71	Earl R. Combs, Inc. 1982. Alaska Peninsula Socioeconomic and Sociocultural Systems and Analysis.
TR 73	University of Alaska Institute of Social and Economic Research, June 1982. Economic and Demographic Structural Change in Alaska.
TR 100	University of Alaska Institute of Social and Economic Research, October 1983. Economic and Demographic Systems Analysis, North Slope Borough.
TR 104	ERE Systems, Ltd., December 1984. Barrow Arch Transportation Systems Impact Analysis.
TR 106	University of Alaska Institute of Social and Economic Research, April 1984. Alaska Statewide and Regional Economic and Demographic Systems: Effects of OCS Exploration and Development.
TR 115	University of Alaska Institute of Social and Economic Research, June 1985. Alaska Statewide and Regional Economic and Demographic Systems: Effects of OCS Exploration and Development.
TR 120	University of Alaska Institute of Social and Economic Research, June 1986. Economic and Demographic Systems of the North Slope Borough: Beaufort Sea Lease Sale 97 and Chukchi Sea Lease Sale 109. Vol I. Description and Projections; Vol. II, Data Appendices.
TR 124	University of Alaska Institute of Social and Economic Research, July 1986. Alaska Statewide and Regional Economic and Demographic Systems: Effects of OCS Exploration and Development.
Other	
SR 6	Lawrence Johnson & Associates, March 1985. Review of Outer Continental Shelf Economic and Demographic Impact Modeling for Rural Alaska: Proceedings of a Workshop.
TR 25	Peat, Marwick, Mitchell & Company, November 1979. Second Program Summary Report.

Source: Compiled by the Socioeconomics Panel from information provided by MMS.

during the construction, provides a comprehensive description of the ways Copper Center's society and institutions change and dealt with the associated pressures placed on the community. This study of the community's response to rapid industrialization is useful to show the kinds of changes one might expect in other native Alaskan communities and could suggest steps to be taken or avoided in development elsewhere.

Prediction is a major goal of the Alaska SESP: to forecast the effects of OCS activities in an effort to evaluate the desirability of proposed development and to identify means to plan for and mitigate damage to the human environment. Predictive studies are based on work developed in the other categories. Baseline conditions and development scenarios are used to project effects with and without OCS development. Potential effects are identified and measured using case studies and methodological studies.

The final category contains workshop proceedings and program summaries, the primary purpose of which is public dissemination of results. Although this form of publication does not contribute new information, it does provide brief and accessible summaries of the studies. These sources also can provide an overview of the program, which can be difficult to obtain from reading individual project reports.

Sociocultural Studies

The Alaska SESP has systematically constructed a substantive and scientific socioeconomics program that is based on a broad definition of the human environment. This framework identifies research needs and ensures that individual studies are combined into an integrated whole. Some of the studies show a broad concept of the human environment, and explicitly consider perceptions of risk and the symbolic value of people's activities (e.g., TR 85). The Alaska SESP is a reasonable model that can be favorably compared to the socioeconomics studies programs of virtually any federal or state agency.

However, the existing program has several shortcomings. First, the noneconomic studies focus almost exclusively on native Alaskans. Such a focus is understandable, because these communities are least understood and because they are likely to feel the greatest effect of OCS production: Industrial development in Alaska could threaten entire cultures. However, nonnative communities should not be excluded from sociocultural analyses. For example, many of those who choose to live in Alaska have done so to escape industrialized society. Yet industrial development in Alaska could threaten this last frontier. The nonnative components of Alaskan society should receive more attention from sociocultural studies.

Economic Analyses: Description and Evaluation

The estimated economic effects of OCS exploration and development are the focus of several interdependent subtasks, some of which include technical and social analyses. A useful overview of the structure is provided in the proceedings of a workshop (SR 6), summarized here.

First, a development scenario and associated technical analysis are prepared, in which the number of exploration rigs, platforms, and pipelines and the amount of production are estimated. Next, MMS staff specify the probable location of the onshore facilities and likely transportation routes. MMS then translates the development scenario into employment estimates, which appear to be fixed-coefficient, engineering-type estimates. Although one could question whether there is enough flexibility in the technical relationships to permit appropriate adjustments in labor inputs, for

example, if wages are sufficiently high, this likely constitutes an acceptably small error. These data form the starting point for the economic analysis, which is captured in part by the Rural Alaska Model (RAM), summarized and evaluated independently in SR 5, "Review of Cumulative Impact Assessment and North Slope Borough Development Projects." RAM is an econometric model used to project socioeconomic conditions under various scenarios. It is made up of statewide and regional submodels with three integrated components: economic, fiscal, and demographic.

The economic component divides the Alaskan economy into external forces, those from outside the state and the OCS development process (including such sectors as the mining industry and the federal government), and internal forces, which include the portions of the economy determined from within the state and affected by OCS-related activity. For example, demand for labor and the overall level of employment are defined as those needed to produce the required level of output, and thus are affected by industrial production, including that associated with OCS activity. Alaskan wage rates are jointly determined by mainland wages and by the rate of growth of employment in Alaska. The rate of employment and wage rates determine total wages and salaries. Real disposable income is determined by deflating disposable personal income by a relative price index. The major determinants of Alaska prices are overall prices for the United States and the size and growth rate of the economy. Income determines the demand for local production; thus, income and output are simultaneously determined by the model.

The model's fiscal component provides a framework for analyzing the effects of alternative policies. It calculates tax payments to derive disposable personal income. It assumes a state spending rule and it calculates personnel expenditures, state government employment, and the amount spent on capital improvements, all of which affect the amount of construction activity and therefore the demand for labor.

The demographic component of RAM projects each component of population change—births, deaths, and migration. It uses specific survival rates for various ages, sexes, and races, and age- and race-specific fertility rates to project birth and death rates for the civilian population. Population change is determined by net migration and natural increase. Net migration is determined for relative economic opportunities in Alaska by comparing employment changes and real per capita income in the state relative to the real per capita income in the rest of the country. RAM predicts changes in regional and statewide population, employment, and wages, as well changes in tax revenues and government spending.

The members of the panel concur with independent reviewers, who concluded that the model meets the following criteria in a reasonable fashion (SR 6).

- It is sufficiently detailed.
- It is scientifically and legally defensible.
- It is well documented and can be replicated, although MMS doesn't have access to the Massachusetts Institute of Technology computer on which it runs (MMS obtained access to the model in 1990).
- It makes clear and well-documented assumptions.

The model is sufficiently detailed to estimate employment in Anchorage or Bethel for a given year for the basic economic sectors and to predict annual, real, per capita expenditures by the state government from its general fund (TR 106). An interesting result of using the model is the prediction that the cumulative effect of OCS Sales 97 and 109 would reduce the migration of the native population from the North Slope over the duration of production (TR 120). Therefore, one cumulative effect of OCS activity is expected to be the stabilization of the native population for more than a generation (TR 100 contains further documentation).

In our judgment, the model is sophisticated, carefully designed, and accurate. It is reviewed at least once each year, to integrate new findings about the Alaskan economy, as shown, for example, by comparing TR 115 with TR 106. It is unlikely that many natural-resource-development agencies in the United States or in the world can match it. It is unlikely that many states have a better model of fiscal, income, and population growth. MMS and its consultants have an overall structured view of how to estimate the economic effects of OCS development. Armed with this, MMS commissions studies that produce results useful for and consistent with the overall studies that estimate economic effects. Some of these studies, such as the three-volume TR 137, "A Demographic and Employment Analysis of Selected Rural Alaskan Communities," simply gather basic data—on population, wages, and employment for communities. TR 51, "Western Alaska and Bering-Norton Petroleum Development Scenarios: Commercial Fishing Industry Analysis," identifies three areas of potential effects: labor, the components of the communities' infrastructures, and use of ocean space. The study is forthright about the need for more data to make empirical estimates. Nevertheless, the authors used econometric analysis for another region in Alaska to demonstrate that the petroleum industry does not harm manufacturing employment, including fish processing. The results were corroborated by interviews with workers in the fish-processing industry. Competition for ocean space can occur, particularly because of gear loss caused by debris on the ocean floor and marine traffic. The size of OCS vessels makes them basically noncompetitive with fishing vessels, which moor in small harbors. Specialized services (such as electronic repair) to the petroleum industry could aid the fishing industry, and oil-related structures in the ocean can be used as navigational aids (TR 51).

There are exceptions to the interdependent nature of some studies. It is not apparent how the subject matter of SR 7, detailing the distribution of employment in village corporations, will fit into a study on the effects of oil development, however important the study might be from other perspectives. TR 71, "Alaska Peninsula Socioeconomic and Sociocultural Systems Analysis," is an exceptionally detailed report about economic activity in six communities—it discusses trends in dogfish prices, types of gear used, and the size of fishing vessels—with no apparent purpose or relationship to oil development.

Despite its shortcomings, the process that produced the structure of the Alaska program could be regarded, with minor revision, as a national model for research on the effects of OCS development.

Missing from the research program is any serious attempt to estimate the more broadly social costs associated with oil spills. Outside of indirect studies, such as those on the effects of disrupting subsistence activities, the panel was unable to identify a single research document devoted to this important subject. MMS is currently studying the effects of the *Exxon Valdez* oil spill on native communities, however, and such studies are important and should receive high priority for funding.

Furthermore, the economic analyses are defined quite narrowly by SESP to include macroeconomic effects on employment, income, and population changes. Broader economic analyses, such as analysis of social costs and nonmarket effects, are nonexistent. However, extensive work in the noneconomic disciplines could diminish the importance of economic analyses of nonmarket effects. Furthermore, nonmarket economic methods might not be appropriate for evaluating many of the most important issues related to development of rural Alaska. For example, appraisal of cultural change is beyond the scope of economic analysis. Similarly, social ills potentially associated with OCS development, such as alcoholism, the breakup of the family structure, or the loss of subsistence harvest, involve values that are beyond the current abilities of economic analysis.

With the exceptions of the shortcomings noted above, the Alaska SESP is a well-conceived and carefully constructed program. Of the four MMS regions, only Alaska has a true socioeconomics program, a carefully considered scientific approach that has systematic underlying conceptual structure, that gives a broad definition of the human environment, that has identified study

needs, and that integrates studies to fulfill program requirements. There is no scientific reason that Alaska's program should be so much better than those in other regions, although there are certain features of Alaska (among them is relatively small population) that make it easier to study than other regions.

Nonnative communities should receive attention from sociocultural studies, and economics studies should focus on nonmarket effects, through social cost analyses of oil spills and the potential effects on recreation. Analyses should specifically address the distribution of economic benefits to be obtained from oil development and the implications of various distribution schemes.

5

Conclusions and Recommendations

CONCLUSIONS

The Department of the Interior is required to assess the potential effects on the human environment of OCS gas- and oil-leasing activities, as specified and defined in the Outer Continental Shelf Lands Act (43 U.S.C. §§ 1331-1356, §§ 1801-1866). This requirement challenged the Bureau of Land Management (BLM), the predecessor of the Minerals Management Service (MMS). BLM is neither populated with social scientists nor is it well versed in the issues that surround this subject. In Alaska, BLM (and later, MMS) and the National Oceanic and Atmospheric Administration responded to the challenge, even before the 1978 amendments to the Outer Continental Shelf Lands Act, and developed a credible and extensive socioeconomics program, albeit one that needs augmentation. Little socioeconomics research has been done in other regions, however, even though two of them (the Gulf of Mexico and the Pacific regions) have produced all of the nation's OCS oil and gas.

The Alaska region has a credible and comprehensive socioeconomic studies program. It appears to have an underlying conceptual structure, a broad definition of the human environment, an identification of study needs, and an integration of studies to fulfill program some requirements. There are some shortcomings to the program, however. The noneconomic studies focus almost exclusively on native Alaskans and the economics studies focus almost exclusively on macroanalyses of employment, income, and demographics. The program should be expanded to include social studies of nonnative Alaskans and economic studies that involve social cost analyses of oil spills and the potential effects on recreation and other businesses.

The Alaska program could be further strengthened by providing stronger linkages among the studies. For example, the economic studies provide estimates of employment and income provided by the OCS program, but they are not linked to the critical question of how these economic effects would be distributed among different groups, nor what the resultant socioeconomic effects would be. Other studies in Alaska have no obvious connection to the overall program. Some of them contain exceptionally detailed catalogues of items such as trends in dogfish prices, gear types, and vessel lengths. There is no indication of why such information was collected, how it is to be linked to other studies, or what lessons might be learned from it.

None of the other three regions has a comprehensive socioeconomics program. Much of the considerable expenditure of funds under the heading of socioeconomics studies has been devoted to the identification of archaeological sites (shipwrecks), to the collection of highly aggregated economic and demographic data, and to the funding of scientific meetings that had more ecological and oceanographic than socioeconomic content. Even some studies specifically identified as socioeconomic had substantial components—sometimes a majority—that focused on the natural sciences. The Pacific region has done more than have the other two regions to apply socioeconomic

analyses, but even those studies do not incorporate enough primary data and the program's models are not satisfactorily verified. Finally, it is most unfortunate that the opportunity was not taken to monitor and study the effects of actual development as it occurred, especially in the Gulf of Mexico.

External factors have certainly influenced the development of such striking asymmetry among the four programs. In Alaska, the importance of native populations and their cultures was clearly recognized and that importance is reflected in a variety of federal and state laws. In addition, the total population of Alaska is extremely small compared with the resources available to study it and with the potential value of OCS oil and gas. Nobody in Alaska would be unaffected by a major OCS oil or gas discovery, as the experience with North Slope oil has made clear. That is not the case in Los Angeles, New York, or many other parts of the United States where lease sales have occurred or been planned (although it might be true in some sparsely populated coastal areas). Nonetheless, socioeconomic studies are needed outside of Alaska, for two major reasons in addition to the clear mandate of OCSLA. First, because there has been so much oil and gas activity off the coasts of Louisiana, Texas, and California, a great deal could be learned by studying those places. Second, the vociferous opposition to leasing in many coastal states has made it clear that a great deal needs to be learned.

With the exception of Alaska, the environmental studies program has not proved capable of collecting and analyzing the information needed for assessment and management of effects on the human environment. With the possible exception of the Santa Barbara County Monitoring Program in southern California—which is not an MMS initiative—MMS has no adequate program for collecting the information necessary to monitor changes subsequent to leasing. This is a particular fault for the Gulf of Mexico region.

There is no quick fix to this situation. With the exception of the Alaska program and the monitoring program in southern California, there is not even much to build on. The Alaska program cannot simply be copied for use in other regions, nor could the Southern California program be copied for use in the Gulf of Mexico. The Alaska program evolved within a unique environment, primarily to address questions that do not exist elsewhere. And, for better or worse, the Gulf of Mexico has passed the stage at which the monitoring of individual projects, as is done in southern California, is feasible. That region will require assessment and monitoring of cumulative effects.

In most regions, MMS will have to develop a program from a very small base. The basic outlines of a program must be developed in most regions, as must fundamental appraisals of the situations and needs in each region. Only then can appropriate studies be detailed. The panel can, however, recommend some basic goals for such a program, delineate some fundamental properties that the program must have, and describe a *process* by which a program can be developed by MMS in conjunction with the scientific community.

RECOMMENDATIONS

MMS needs to establish a national, comprehensive, credible socioeconomics studies program. Although its Alaska program is comprehensive and credible, that effort cannot by itself serve as the basis for a national program, although the process by which it was developed could be used as a model.

Goals

To establish a national, comprehensive, credible socioeconomics studies program, MMS should begin with the following goals.

- Create a socioeconomic research program that is national in scope and, as a result, that can generalize applicable findings from one region to another. At the same time the program must account for regional variations in study design and implementation. The program must have an established scientific integrity.
- Use the program to collect the information required by OCSLA and necessary to elucidate the implications of OCS activities at all stages, from preleasing to termination. The schedules of the planning process described in Table 1-4 and the timing of studies should be compatible with each other.

Scientific Personnel

To Accomplish Its Goals, MMS Needs to Strengthen its in-house expertise in socioeconomicdisciplines, especially outside of Alaska.

The scientific expertise of MMS's regional staff matches (at least approximately) the mix of studies that the regions fund. Especially outside of Alaska, additional regional scientific staff will be needed to develop credible and useful studies of economics, sociology, cultural anthropology, and political science. Developing credible socioeconomics programs outside of Alaska will require an increase in funding for socioeconomic studies.

Process

MMS should establish a process to identify, in general terms, the socioeconomics information it needs and a process to translate that description into a program of studies.

The above recommendation is simple, but it is important. Because it is not yet clear to anyone, including members of the panel, exactly what information is needed in each region outside of Alaska, it is essential that MMS develop a credible process to determine its needs, as it did in Alaska. Without that process, its studies will be unfocused, perhaps irrelevant, and difficult to defend. Despite numerous conversations, meetings, and informal interactions with MMS personnel at all levels of the organization, the panel did not obtain a clear indication of what socioeconomic information the agency believes it needs, even though officials frequently stated that MMS needs information for decision making. There are actually two questions involved in the relationship between information and decision making. First, what have been, or probably will be, the effects of a particular action? Second, are these effects great enough to warrant postponement, cancellation, or alteration of a proposed action? Only the first question can be addressed by scientific research. For practical purposes, the effects of OCS activities must be limited to a reasonable agenda. A process to accomplish this would assess the agency's national and local information needs and the ability of the scientific community to supply the data. Then it will be possible to define specific national and local research agendas. The basics of one approach to this process are outlined below. It is similar to, although more extensive than, the one used to develop the Alaska Socioeconomics Studies Program.

- **Delineate the generic socioeconomic information needs of the agency.** Start by holding workshops or meetings between MMS personnel and members of the scientific community knowledgeable about OCS activities. (The Pacific Region made this start with a workshop held in

1989 (MMS, 1991e).) The first meetings should be appropriately broad. The focus should not be on whether there have been or could be specific effects as a result of OCS activities, but rather on what effects could be included for consideration in a research agenda and what methods exist to assess them. This first step would identify the broad dimensions of a research agenda in a cooperative venture between MMS and the scientific community.

- **Delineate regional variations that should further define the research effort in the various regions and subregions.** For example, as noted above, a large OCS oil or gas discovery in Alaska would probably affect every resident of the state, even if development were environmentally invisible. (As an illustration, North Slope oil revenues constitute a significant portion of the budgets of the state and of nearly every resident of Alaska.) A large discovery near a large, economically and socially diverse population like that in southern California would probably not affect all—or even most—residents unless there were a major spill or a major environmental problem such as air pollution. Thus, it is immediately clear that socioeconomic concerns would be substantially different in two such areas. How would a discovery affect a relatively small, isolated population like that of California's north coast or a larger, but still relatively isolated, population like that of the Florida Keys? What can be learned from experiences in other places?

  Another question might be the extent to which the total economic and social base is tied to the biophysical environment. Although the coastal environment is extremely important to residents of eastern Massachusetts, it might not be as central to their activities as the coast is in Bristol Bay, Alaska. It surely is less central to the residents of New York City. In other words, an oil spill or the presence of oil platforms might affect every resident of Bristol Bay or the Florida Keys, because the perceived quality of the environment is so central to people's economic and recreational activities there.

  With the broad considerations in hand, regional workshops or meetings between the appropriate MMS personnel, knowledgeable members of the scientific community, and members of the affected public should narrow the focus of the regional research agenda and allow priorities to be set. Again, until the agenda is set forth conceptually, individual studies should probably not be considered except as examples.

  It is essential to involve the public at this stage. Although the public will not set the research agenda directly, nobody knows better than they what their concerns, fears, hopes, expectations, and values are. Thus, MMS might learn from the exercise that one concern is that roads will be built in an area used for recreation. Knowing that would allow MMS to study ways to avoid or minimize such an effect. On the other hand, MMS might learn that the public is opposed to the industrialization of an area that would attend the extraction of oil and gas from the adjacent outer continental shelf. In such a case, mitigation might be more difficult or even impossible, but at least MMS would have valuable information to provide to decision makers. The information could lead to identification of appropriate compensation and to relevant studies of the affected area and others.
- **Translate the narrowed research agenda into specific studies in order of priority.** Some expertise, and a better understanding of social science issues, should result from the first two steps. However, cooperation with the scientific community is still desirable here. Workshops, conferences, seminars, the use of consultants, or combinations there of would be useful. In this, as well as all other stages of the process, MMS should take advantage of the experience and expertise of its scientific committee and regional technical working groups.
- **Review and revise standard MMS funding criteria and explore creative funding strategies for smaller studies.** During its association with the Environmental Studies Program, it has

become evident to the panel that MMS's standard funding procedures are inadequate for areas other than Alaska. Social science research is less likely than other kinds of studies to make the funding cut-off under the funding criteria MMS uses. Those criteria are most responsive to potential litigation, and, outside of Alaska, effects on the human environment have seldom ended up in the courts. Even when these studies do make the cut-off, problems still exist. Some requests for proposals issued over the past several years under the standard MMS format have not resulted in funded studies. It is not clear whether this is due to the lack of a process for identifying appropriate projects by MMS or an inability of the scientific community to respond to MMS's requests. Recent social science research funded by MMS through the university initiatives in the Gulf of Mexico and Pacific regions are examples of a potentially effective funding mechanism. Although they are regionally focused, they might benefit by being opened to proposals from researchers from any part of the country.

- **Use the full range of social science methods in designing specific studies.** These options include empirical research, often involving surveys and questionnaires, with the attendant necessity of OMB approval. Secondary data analysis and the community studies that have been characteristic of past MMS research also are valuable tools and should be continued.

The most important point in the process outlined above is that a generic research agenda, at least in some regions, must be established before specific studies can be evaluated in light of MMS's information needs. Although Alaska's program was developed as the result of a workshop that involved the scientific community, it too would benefit from additional thoughtful participation from the scientific community and the public.

General Considerations

Scientific integrity is a prerequisite for success. Clarification of what this means is essential. At least part of the origin of the disagreements between MMS's management and the scientists who advise MMS on its work or criticize it stems from mutual misunderstanding about the different kinds of knowledge the two groups require. Those disagreements lead to disagreements about what methods should be used and what standards should be adopted.

The Minerals Management Service is not the National Science Foundation; it is not equipped or expected to produce new or fundamental knowledge that has no apparent relationship to its mission. Such discoveries can occur as a result of research focused on MMS's missions, but they are not a prerequisite for research to be useful to MMS. In addition, publication of research results in peer-reviewed journals lends credibility to any program, but not all the information MMS needs is necessarily of broad academic interest. Although peer-reviewed publication should continue to be encouraged by MMS and is extremely desirable in general, it is not a necessary or sufficient criterion for evaluating the usefulness of any particular piece of research to MMS. However, even if the information is not intended for publication, it should be subjected to the same tests of scientific quality that apply to published material.

Research intended to identify, define, and solve problems—policy-relevant research—is the kind of research that MMS needs to support. Collection and maintenance of long-term environmental observations, such as weather or stream-flow records, is an important element of this kind of research. Information about the distribution, abundance, and feeding habits of various species and measurements of currents for assessing the likely paths of oil and other discharges are examples from ecology and physical oceanography. In the social sciences, examples would include gathering demographic data to characterize the nature and trends of local populations, including migratory habits and patterns; cultural baseline studies to reveal who and what might be at risk in the event of

disruptions caused by development; attitude and value surveys; and social and economic analyses of current and likely future effects in a locality or region, including effects on basic labor, occupational safety, health, and education. An essential part of this kind of research is *monitoring*. Monitoring should be used to determine trends and to assess the effects of policy and practice. The monitoring of the effects of policies, projects, and regulations is sadly deficient among government agencies in many areas of concern.

The Minerals Management Service must trust and use the socioeconomic information collected through the Environmental Studies Program, both to inform decision making and to refine its research program. Other interested parties must trust and use the information as well, or it will have limited usefulness. The establishment of a scientifically credible program is a prerequisite to the development of confidence in the information.

Scientific inquiry is itself a process, and quick answers to questions and solutions to problems are often not possible. No matter how well MMS's research agenda is defined, complete knowledge is not possible, nor is it a reasonable expectation. Progress, however, is. Deciding what factors warrant postponement, cancellation, or alteration of plans for OCS activities is not a scientific process. Identifying and describing concerns, questions, information gaps, and mitigation measures should be a scientific process.

The Minerals Management Service must recognize that government officials have viewpoints—sometimes many viewpoints—and that there is no particular reason to expect the government view to be understood or even widely shared by other—especially if the others are far removed or culturally diverse. In other words, the officials' understandings and definitions of OCS issues and problems—and solutions to them—are as much based on those persons' perceptions, biases, culture, and experience as are those of any other affected person or community. It is important that MMS recognize and understand this.

The process described above will require time, patience, commitment, and some additional money to develop a viable research program. However, MMS has demonstrated by its actions in Alaska—and to some degree by aspects of its biological and physical studies elsewhere—that it is capable of success and that success need not take decades or require an enormous increase in its budget. To date, the alternatives have not worked very well.

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Appendix A

COMMISSION ON PHYSICAL SCIENCES, MATHEMATICS, AND RESOURCES

Appendix B was prepared by Socioeconomics Panel member Roy Rappaport and Appendix C by panel members Biliana Cicin-Sain, Robert Gramling, Ralph Johnson, and Charles Wolf. The panel made much use of these papers in its reports. The papers themselves, however, reflect the opinions and judgments of their authors and do not necessarily represent the views of any National Research Council committee or board.

Appendix B

THE HUMAN ENVIRONMENT

by R. Rappaport

This appendix to *Assessment of the U.S. Outer Continental Shelf Environmental Studies Program: Part III, Social and Economic Studies*, discusses possible impacts of outer continental shelf oil and gas development (OCS) on the "human environment." Any understanding or assessment of the full range of such impacts requires the integration of social, cultural, political, psychological, and economic analyses. Furthermore, although every human environment is in important respects unique and although its unique features must be considered analytically, a generally consistent mode of analysis should be adopted if studies are to be useful.

The first section discusses the concept of the human environment. The second section lays out some general considerations, principles, and assumptions that underly the approach taken here to examining effects on the human environment. The third section presents a framework for organizing materials when considering potential impacts and makes specific suggestions for dealing with the effects. The third section contains three subsections, the first of which considers activities that are likely to produce impacts at each of the several stages of OCS activity, the second the dimensions of those impacts, and the third their distribution. The final section of the appendix presents a mode of analysis sufficiently general and flexible to accommodate the particulars of any region and at the same time to permit meaningful extrapolation, comparison, and generalization of results.

THE NATURE OF HUMAN ENVIRONMENTS

The Outer Continental Shelf Lands Act as amended in 1978 (43 U.S.C. §§1331-1356, §§1801-1866) mandates consideration of impacts on the human environment in all decisions concerning the leasing and development of offshore tracts. The term "human environment" was meant to include not only features of ecosystems as perceived by, related to, or modified by human populations, but those human populations and their social and economic systems as well.[1] Because

[1] The actual language is as follows: "The term 'human environment' means the physical, social, and economic components, conditions, and factors which interactively determine the state, condition, and quality of living conditions, employment, and health of those affected, directly or indirectly, by activities occurring on the Outer Continental

this simple characterization masks enormous complexity, it is necessary to enlarge on the distinctive nature of human environments before considering the possible effects on them from OCS leasing.

Human systems are complex not only because they include innumerable forces in continuous interaction but because some of the components included are categorically different from others. To be more specific, some of the components of human systems (including humans themselves) are the natural products, as it were, of the processes of genetics, geology, and ecology. Others, however—the socioeconomic elements of such systems—are symbolically conceived and socially constructed. This latter class includes the more-or-less distinctive political, legal, economic, social, religious, recreational, and aesthetic conventions of human communities. "Conventions" are rules, practices, ways of doing things standardized by law, custom, or habitual usage and, furthermore, the conceptions, perceptions, and understandings on which these rules and practices are founded. Several points follow.

First, human systems include a range of demographic, economic, physical, and social features and activities that are no less important for their being relatively obvious and straightforward. We can list here as examples population size and specific demographic and sociocultural composition; birth, death, and morbidity rates; and general conditions of health; patterns and rates of immigration and emigration; areal extent of populations; dominant economic activities; economic diversity (with special attention to tourism, fishing, and other maritime usages); employment and unemployment patterns and rates; household income; land-use patterns; transportation routes; traffic patterns and capacities; the tax base; government services such as education; infrastructure maintenance; police protection; and recreational facilities. Socioeconomic research done by the Minerals Management Service (MMS) of the Department of the Interior has been, in the main, confined to these more concrete and measurable features.

Second, it does not diminish the importance of demographic and economic aspects of human systems to make explicit, as has already been implied, that any adequate description of such systems must also take into account their social, symbolic, and conceptual elements. Indeed, economic systems are subsets of social systems and inasmuch as they are conventionally established and not "naturally" constituted, they are themselves social and symbolic in nature. An "economy" is, after all, a set of conventions—institutions, rules, understandings, and practices—for organizing the extraction, production, distribution, and consumption of goods, and the value of money is purely conventional.

It has already been noted that symbolically conceived and socially constructed conventions organize all aspects of human life. It is important to make explicit that the understandings on which conventional rules and practices are founded include not only those narrowly focused on specific aspects of human affairs but also more general and, from the point of view of the actors, more fundamental conceptions that govern morality, equity, justice, honor; religious doctrine; ideas concerning sovereignty, property, rights and duties; aesthetic values and what constitutes quality of life.[2] There also are distinctive understandings concerning the nature of nature, of the place of humans in it, of proper behavior with respect to it, and of equitable distribution of its fruits, its costs, and its dangers. At levels deeper than those occupied by substantive understandings and values, conceptions include assumptions about the nature of reality: what is given, what requires

[2] For discussions of the ways in which this apparently vague concept has been assimilated into official government discourse all over the world, see Brewer and Brunner, 1975, and Gross, 1967. On problems of operationalization see Dalkey et al., 1970. On the general concept see Campbell, et al. (1976) and Rappaport (1978).

Shelf. . . ." (43 USC 1331(i)).

demonstration, what constitutes evidence, how knowledge is gained. Such loosely structured bodies of understandings and the conventions and practices they inform are what anthropologists call "cultures," and what laypeople probably mean by such looser phrases as "way of life" or "traditions." It should be clear that although the demographic and economic aspects of human systems are relatively amenable to numerical representation, other aspects of society and culture, including some of those just listed, are not. They are no less real for that, however, nor are they less compelling as factors in human affairs for, as vaguely articulated as they sometimes are, they command great loyalty.

Third, although it is proper to speak of a generalized American society and culture, it must be kept in mind that regional, ethnic, class, and other differences play variations on that common theme. In some instances—native American groups stand out in this regard—the local version diverges widely from generalized American culture. In all instances the divergence is significant. It follows that the features of sociocultural systems in any area in which OCS development is being considered cannot be taken for granted: They must be explored.

Fourth, the last two points imply that it is necessary to develop understandings of the sociocultural systems in areas where there is a possibility of OCS development because sociocultural impacts are *always* in part relative to the particulars of the affected sociocultural system. For instance, it would be one thing for a spill to decimate fish and other marine life in an area exploited only by white American commercial fishermen and quite another to decimate an equivalent fauna in Bristol Bay, Alaska, which is fished and hunted by Yupik-speaking Eskimo. In the instance of the white fishermen the loss of the fishery is an economic loss. In the case of the Yupik the loss is not simply economic, because subsistence activities are central to Yupik cultural reproduction—the Yupik maintain that the destruction of their fishery would constitute genocide. It would be more accurate to call it "ethnicide": the people would live, but the quality of their lives would be badly damaged by the death of their culture.

Given this complexity, the conception of the human environment on which MMS studies have been based seems impoverished. To the extent that the concept has been formulated at all, it seems to have been conceived only terms of economics, demographics, and government. But adequate consideration of ultracomplex human systems, constituted as they are of conventions, rules, practices, and conceptions, as well as physical structures and features of the landscape, must rely on social, cultural (anthropological), and even psychological analyses as well. An integrated approach is required if information that is adequate to the gravity of OCS leasing and development is to be available to decision makers. This framework needs to be sufficiently comprehensive to allow the full range of phenomena constituting human systems to enter into the analyses and it must be inclusive enough to take into consideration the concerns of all interested parties—especially those who are likely to experience the impacts most directly. It should, furthermore, be sufficiently consistent to make for reasonably commensurate studies, thus facilitating extrapolation, comparison, and generalization—in short, to encourage learning from experience.

SOME GENERAL OBSERVATIONS, ASSUMPTIONS, AND PRINCIPLES

Before considering impacts on human environments, some general observations, principles, and assumptions that follow from the nature of human environments need to be made explicit.

1. Because socioeconomic systems are ultracomplex, and because they are always unique in at least some particulars (although possessing in common certain very general features), the range of

possible social, cultural, and economic effects on them of activities such as those related to recovery of OCS oil and gas resources cannot be specified, even in principle, in advance of studies that include empirical research, judicious extrapolations from experience, and methodologically sound projections.

Given this intrinsic complexity and particularity it is not legitimate to stipulate beforehand any limitations on what qualifies as social, cultural, or economic impacts. The establishment of such limitations constitutes an attempt to legislate reality, although the degree to which reality is amenable to such legislation is slight. Consequently, any limitation on the nature of what counts as a "real" impact (that it is physical or that it is amenable to representation in quantitative terms generally or in monetary terms specifically, for example) only misrepresent actual conditions. Given the responsiveness of human systems such misrepresentations are likely to have political, legal, and social effects that extend beyond those that attend the initial effect being defined.

2. Humans respond not only to events themselves but to information concerning events. Indeed, in this age of rapid communication, the overwhelming preponderance of response is not to the direct impact of events, but to news of those events. When information concerning physical events, rather than the events themselves, act as a stimulus, the physical events need not have yet occurred for there to be significant effects. Thus *apprehensions* about aesthetically unpleasing developments, for instance, or about decreased recreational possibilities, environmental pollution, or other diminishments of life's quality—and not simply the actual developments themselves—are real and immediate effects, and they are likely to lead to further ones. Moreover, *uncertainty* concerning the future of a region ineluctably increases from the moment a tract appears on a five-year plan until the failure of a lease sale or until exploration ends in either abandonment of the leasehold or in drilling. Such uncertainty also constitutes a real impact of OCS activity.

   Both apprehension and uncertainty about OCS activities and their predicted consequences are properly construed as impacts in the present because they alter the current psychic, social, and perhaps economic well-being of a community and because they stand in causal relationship to the future attitudes and behavior of that group of people.

3. It follows, but it is worth making explicit, that in ultracomplex systems in which humans are actors, some effects, particularly social effects and political actions, are not simply linear results of actions, as they may be in simple physical systems. Between causes and effects—that is, between perturbing factors and responses to them—lie understandings and evaluations not only of how the world is constructed and how it works but of how it *should* be constructed and how it *should* work. It is in terms of the latter (values) that the former (perceptions of actual states of affairs) are interpreted and evaluated. These values, it is hardly necessary to say, are socially constructed and are culturally and even subculturally variant.

4. The relationship between the news of an event and the physical characteristics of the event is not simple. News is not a simple function of an event; it is subject to amplification, dampening, editing, distortion, etc. in whatever channels it passes through, and requires interpretation by the receiver. Interpretation takes into account the reliability of the transmitter (source) and the channel (medium).

   It is well to emphasize here that maintenance of credibility can be a serious problem for both transmitters and channels, and the loss of credibility can be a consequence of these actors' responses to events. For instance, OCS EISs that an affected public takes to be inadequate or misleading can discredit their source, which can be interpreted to be MMS, DOI as a whole, the federal government as a whole, or even the party or person occupying the White House. Furthermore, there are grounds for believing that ill effects are perceived to be both more likely and more severe when information

sources are distrusted. Such perceptions can lead people to oppose even a project that could benefit them.

5. If impacts include responses of systems to perturbations, then the legal, political, and organizational responses of states, municipalities, industrial and trade associations, native American tribes, or environmental groups to announcements of OCS plans must be regarded as impacts. So must their opportunity costs, as must any conflicts that develop among state, local, and other groups as incompatibilities in their interests or positions become apparent. Conflicts between any and all of the other party and the federal government must be considered effects as well.
6. The previous points suggest that it may be possible to discern a general sequence in which impacts of different nature become dominant. Earliest effects, those following soon after the listing of a region on a five-year-plan, are likely to include, most prominently, increased apprehension and uncertainty about subsequent ecological, aesthetic, recreational, economic, and other alterations that could attend future OCS development. Apprehension is unevenly distributed in the population, of course, and immediately subsequent effects are likely to include attempts by more sensitive elements of the population (environmentalists, fishermen, state environmental agencies) to raise concern among the less sensitive. Increased legal and political activity by state and local agencies and already existing environmental groups and trade associations can soon follow, but often special state and local bureaucracies and special purpose grass roots organizations can spring into being. Conflict among those taking various positions comes next. All of this happens before any sale takes place. Subsequent to the sale, exploration and production have their own effects, including disaster and its possibility, and so, finally, does termination, subsequent to which there may be as yet unexplored residual effects.
7. That certain important consequences of gas and oil related OCS activity can be strongly felt well in advance of any actual physical activity on the part of oil companies may contradict some recent court decisions. It could be that the general failure to recognize prelease sale effects of OCS activities is related to their typical resistance to plausible quantitative representation. More easily quantifiable impacts—those most directly available to quantitative or even monetary representation—generally come later in the sequence. Because the early effects resist representation in terms with which many or most administrators are accustomed to approaching them, public discussion of early impacts has been hampered.
8. It is clear that some events or developments, and their consequences, seem to be in their nature metrical, or at least such as to make it possible to represent some of their aspects in numerical terms. An increase, for instance, in local population as a consequence of immigration of workers in connection with the construction and operation of a new industrial facility lends itself to numerical representation, and precise numbers may be plausibly and sometimes accurately predicted. So, perhaps, may be the monetary costs of expanding municipal services sufficiently to cope with the projected expansion of population. The effects of the uncertainty attending the possibility of OCS development on the value of beach-front real estate can often be precisely, accurately (and painfully) ascertained.

   Other aspects of the same events, however (for instance, possible tension arising out of disparities between the ethnic or socioeconomic backgrounds of newcomers and established residents), cannot be represented numerically, and it should be clear that a good many significant effects of OCS and other developments—the psychic and social tensions that attend uncertainty, or anger at and alienation from the government—cannot be represented adequately, or even at all, in quantitative

terms of any sort, let alone monetary terms. This is not to say that the prevalence of various opinions cannot or should not be sampled.

It is one thing, however, to quantify the prevalence of particular opinions on particular issues as they may be indicated by responses to the limited range of choices offered by particular questions asked at particular moments in an ever-changing history, and another to grasp the underlying structures of understanding out of which these opinions (and those with more nuance) emerge in response to unfolding events. Attempts to force the representation of such structures of understanding into inappropriately quantitative terms or, alternatively, to dismiss them because they cannot be so represented is to misrepresent reality. The aesthetic considerations of affected populations, for instance, or violations of their religious beliefs, or of their conceptions of equity, or even of their vague conceptions of the good life, cannot be ruled inadmissible because they resist monetary representation, or even quantitative representation of any sort, for they could well be—are even likely to be—the most significant factors for those populations in developing attitudes and taking action. These considerations cannot be disqualified as mere prejudices of uninformed laypeople. They are embedded in views of the world no more and no less arbitrary than other views of the world, and as such have valid claims to reality. They are social facts that will serve as grounds for action.

In sum, metrical representation (including the results of opinion surveys) should be pushed to the limits of plausibility but no further, and it is necessary to recognize that other considerations, often decisive ones, lie beyond the reach of plausible numerical representation. Attempts to reduce radically unmeasurable components of the world to common metrics as a preliminary to "bottom-line" calculations are not justified as an aid to clear thinking—the clarity and certainty so claimed is false.

9. The phrase "significant effects" requires comment. The term "significant" is taken here in both of its major senses. It means both "important" or "consequential" on the one hand and "meaningful" on the other. To say that a phenomenon is meaningful in this context is to say that it enters into the motivational processes of actors. This implies that values are of crucial importance in the arena of impact assessment and, therefore, that their consideration cannot be avoided. Risk assessment cannot be value free because values define what is at risk, and what is at risk may be values themselves.

There are numerical approaches to value and values—indeed, in some of its aspects the conception of value, particularly when accompanied by a modifier ("food value" or "monetary value") seems intrinsically metrical. But the term also refers to conceptions like "truth," "honor," "beauty," "equity," "honesty," "wholeness," "integrity," "sanctity," "trustworthiness," "life," "liberty," and "happiness." Two subsidiary points are to be made here.

First, most, if not all, of these values are not merely nonmetrical in nature; there is a radical incompatibility between them and metrics of any sort, and there is an absolute contradiction between some of them and monetary valorization. This contradiction is indicated by such questions as "How much money is your integrity (or trustworthiness or honesty or vote) worth?" Such values are misrepresented if they are represented metrically; the assignment of monetary values to them renders them false. Attempts to mitigate violations of them through cash awards are likely to be taken by those to whom they are offered as insults heaped on previous injuries. Thus, for instance, the Shoshone have refused to accept a cash award of tens of millions of dollars as compensation for what they construe to be seizure of their lands by the federal government in violation of the Ruby Valley Treaty of 1863, and the amount has remained in escrow for more than 30 years. Similarly, many people in Nevada characterized as attempted bribery the suggestion that they receive large cash payments in return for accepting the national nuclear waste repository.

The second subsidiary point: fundamental or basic values tend, in their nature, to be very low in specificity. What is it, after all, that constitutes "liberty" or "happiness," or for that matter,

"life?" To say, however, that values are not specific or even vague does not say that they are not cogent, or even decisive, in the formation of positions on which social actors stand, from which they define the general conceptual, social and geographic territory which they feel is rightfully theirs, and from which they will act. It could well be that there is a direct correlation between the vagueness of a value and the strength of the motivations it engenders. People will put their lives in danger to protect whatever they mean by "liberty" or "democracy," but not to balance the budget.

10. A general value of sufficient significance to warrant special mention is fairness, because Americans are likely to take OCS oil and gas related activity to be in its nature unfair. Two aspects of equity can be perceived as under attack. First, there is the question of distributional equity. Affected populations seem quick to perceive that the most substantial benefits of development are likely to flow to parties other than those most directly exposed to the risks. Second, and even deeper, it seems that the attitude of publics to public land is that it is in some sense *theirs*. That a private interest, or an alien interest, can curtail or endanger their use of what they see as their own (whether it is their private property or a public amenity) violates not only a deep sense of right, but possibly a deep sense of connection to place: "Who are *they* that they can endanger *our* wetlands (or ducks, or fish or beach)?" A public sense of violation and its attendant feelings of outrage and alienation are properly regarded as possible impacts of OCS activity, as are any political reactions that ensue.
11. The next point is related. Communities can take projected OCS developments to endanger something that may seem even vaguer and more general than fundamental values. They can refer to whatever it is as their "way of life," or they might use the slightly more complicated term, "culture." At the heart of a "culture" or "way of life" are symbolically mediated and socially constructed sets of assumptions about the nature of the world and its inhabitants, and they are realized and maintained through customary action. Among certain native Americans, and the inhabitants of coastal Alaska are prominent in this regard, the customary actions through which indigenous culture is maintained and reproduced are in the main those surrounding subsistence activities. This is to say that hunting and fishing are of importance not only, or even any longer primarily, as the way to obtain food and fur. They are the main means by which Eskimo, Aleut, and other indigenous cultures are kept alive, and perceived threats to them will be bitterly resented and resisted.

    Given their cultural centrality, there is no way to compensate such peoples for the loss of their subsistence bases. As already reported, Eskimo informants say that developments that would make traditional subsistence practices impossible would be equivalent to genocide. It need hardly be said that there is no valid way to assign a monetary value to a culture, or to its disappearance. Such impacts are, Eskimo informants insist, unmitigable.

    Violations of a community's values or threats to its way of life must be understood to constitute, in and of themselves, serious impacts on that community. It can be suggested as a hypothesis that the less amenable to metrical representation and the vaguer the threatened value is, the stronger will be the response to its violation, for in such instances the defenders understand themselves to be acting on general principle rather than from a personal interest.
12. It follows, and indeed may be in the nature of human systems generally, that violations of a community's conceptions of its rights in its local surroundings, or of its conceptions of justice and equity, or perceived threats to its general "way of life," or to its basic canons of reality, frequently will take precedence over material considerations in the conduct of community affairs. It could further be characteristic of human systems that actions undertaken in the name of justice, say, or environmental integrity, or in defense of a way of life, or of basic conceptions of reality are likely to be more highly charged emotionally, more physical, and more aggressive than are those undertaken

in the service of economic or material advantage. It is of interest that the "higher principles" invoked in response to perceived threats to a way of life or its highly valued constituents license, or even sanctify, forms of action that the actors themselves would in other circumstances condemn, or at least declare illegitimate. Examples include the civil disobedience campaigns in the American south, and of otherwise law-abiding citizens breaking laws in "pro-choice" versus "pro-life" confrontations. But even when such actions are illegal or criminal, they are viewed by their partisans as legitimate or even heroic—and their partisans are often legion.

13. This account proposes that when a community's concerns are ignored by analysts and decision makers the matters at issue change. The dominant issues become matters of "high principle." When issues are escalated to the level of high principle, they are no longer objective items of dispute that can be resolved through the establishment of fact or through the logic of costs and benefits; in the "principled mode" self-sacrifice is more highly valued than is material benefit. The issues might already have so escalated in California and Florida (OCS Leasing and Development Task Force, 1990). Escalation into the "principled mode" should be counted among possible impacts of OCS activity.
14. An implication of the discussion so far is that whether or not a community's understanding of the world's nature, or whether or not their values concerning it are "realistic" in terms of "objective" canons of reality established by disinterested analysts, or whether or not the community's fears are, in the view of analysts or officials, fanciful is, in some degree, beside the point. Impacts are, in considerable degree, to be understood relative to the affected community's definitions of reality.

    It follows that analysts and decision makers must assume that the views of an environment held by those living in it are realistic even if community views differ from those of the "outsiders. Analysts and decision makers must not, therefore, dismiss the apprehensions of local populations concerning risks and their probabilities as paranoid or misinformed. To put it a little differently, the concerns of local people must be given full and respectful treatment because it is the environment as *they* conceive it that, as far as *they* are concerned, will be affected, and it is in terms of these understandings that the community will respond to OCS activity. An exploration of these conceptions is, therefore, a necessary part of any adequate analysis. Failure to give full and respectful treatment to local conceptions, perceptions, and apprehensions has, in the past, led to widespread citizen alienation and anger; to political and legal action; and even to threats of violence. Such responses are themselves to be considered impacts of OCS activity, and often grave ones at that.
15. At an even deeper level, such questions as "Our concerns are so obvious, why can't MMS understand them?"—a question asked of the Socioeconomics Panel by people as diverse as Yupik-speaking Eskimos on the coast of Bristol Bay, Alaska and state and local officials in southern Florida—suggest that failure to take seriously or to consider respectfully citizens' concerns are perceived as challenges to their fundamental understandings of reality. It can further be suggested that for a community to have its understandings of reality disregarded by a powerful authority is profoundly alienating, for it leaves no common ground on which the community and the authority can stand. There is nothing left to do but fight.
16. Note, however, the qualifications "in some degree" and "in considerable degree." It would be a serious error to suppose that impacts are to be defined only in relation to the community's understandings, for many serious consequences can be unforeseen by those who will be exposed to them. It is the responsibility of those who prepare environmental impact statements not only to grant

reality to the concerns of affected communities but to bring to the attention of those communities effects that they might not anticipate.

17. It is important to note that unforeseen as well as foreseen impacts may well include beneficial as well as harmful effects. Thus, for instance, onshore infrastructural developments associated with offshore installations, such as new or improved roads, not only increase the amenities available to people living in remote areas, but even make positive contributions to the quality and length of their lives by making medical care more accessible. That this discussion has not emphasized positive impacts does not constitute a claim that positive impacts are inconsequential or do not deserve attention. It reflects what appears to be the dominant orientation of populations in regions affected by OCS activities. Possible positive as well as negative impacts should be honestly represented in both environmental studies and environmental impact statements.

18. It follows from all of the points so far noted that impact studies themselves are not devoid of possible impacts. For an impact statement to ignore, dismiss, disqualify, underestimate or, in the view of affected parties, misrepresent or represent inadequately their concerns is for the statement itself to provide evidence to those affected parties that they are being unjustly treated. It is both plausible and prudent to assume that the community will respond to perceptions of injustice in whatever ways are available and that they deem appropriate. Active responses can include emigrating—likely when strong opposition combines with the sense of powerlessness and failure of trust in the institutions responsible; voting those viewed as responsible out of office as soon as possible; or more aggressive forms of political activism, such as forming ad hoc organizations, demonstrating, or even committing sabotage. Such responses are themselves to be include among possible social consequences of OCS activity likely to be evoked by inadequate impact statements.

    That such overt actions fail to materialize should not be taken to indicate unambiguously that projected developments or officially published environmental impact statements have elicited no responses, for responses can be passive. "Passive responses" are cognitive and attitudinal effects unaccompanied by overt action. The operative cognitive and attitudinal stance resulting from impact studies that the affected community finds inadequate, unfair, or dishonest may well combine feelings of powerlessness and increased cynicism (concerning public institutions and their control) into a sense of alienation. From such a perspective any and all action may seem futile. That people come to believe the adage about the impossibility of fighting city hall, and act—or do not act—accordingly, is itself a possible response to, and thus an effect of, impact statements.

    Increases in certain forms of social pathology (substance abuse and domestic violence) may be related to, or even aspects of, passive responses in situations of powerlessness.

19. Among the most significant components of environmental impact statements, as far as affected communities are concerned, may well be estimates concerning the probability of spills and the magnitude of their effects. If the probabilities of spills are represented (rightly or wrongly) to be much lower than the common sense of the community projects, or if their effects are, in the community's view, significantly underestimated, and if these projections cannot be effectively defended, the trustworthiness of the institutions responsible for the preparation of the impact statement will come into serious question. In the cases at hand these institutions include, in the first instance, MMS, but unless clear instances in which the general DOI position has varied from (if not resulted in the reversal of) the MMS position are known to the community, the integrity, or even legitimacy, of DOI generally may be impeached coincidentally with that of its constituent agency. DOI, in turn, is itself an agency of the federal government, and deterioration of trust in it may undermine confidence in the federal government generally. Higher agencies and authorities increase their vulnerability in

this regard when they themselves enter into the decisions concerning such matters as lease sales. They become yet more vulnerable when they enter into the processes through which such decisions are reached, as in the case of the presidential task force on the California and Florida leases (OCS Leasing and Development Task Force, 1990). Undermining the confidence of the community in agencies of the government, or even questioning the legitimacy of government itself should be regarded as a possible impact of impact studies themselves.

20. The last point alluded to "affected communities," but full analytical isolation of "affected communities" from those that are not affected is impossible if the term "affected communities" is understood to mean all of those that take themselves to be in some way threatened and all of those in which active or passive responses take place. It is obvious that communities in Alaska, for instance, have been much more directly and seriously affected by recent events in Prince William Sound that resulted from the *Exxon Valdez* oil spill than have communities elsewhere, but there have been, and will continue to be, responses to the Alaskan events in communities and among people far distant from Alaska. Thus, for instance, the Alaskan events were continually alluded to by citizens speaking at the first presidential task force workshop in Carlsbad, California in May 1989 in opposition to the southern California lease sale, and by officials and citizens speaking during the Socioeconomics Panel hearings in both northern California and southern Florida. There have also been responses across the nation. Such nonlocal responses must, of course, be included in any serious and comprehensive account of the impacts of OCS oil and gas leasing activities.

    The responses of those distant from the site of an event have varied in ways that could not have been fully predicted, and they can be fully grasped only through empirical research. It can be suggested with some confidence, however, that the responses have combined to produce a cognitive, social, political, cultural, and perhaps even economic environment increasingly hostile to OCS activity. To use a medical metaphor, the *Exxon Valdez* may have "inoculated" the society against OCS activity, stimulating organizational, cultural, cognitive, and political "antibodies" against further OCS development throughout the entire society. The Kill van Kull spills and the *Mega Borg* rupture could be regarded as booster shots. The antibody effect must be included among the possible impacts of OCS activity.

21. Discussion of the antibody effect, which entails extrapolation from actual events to future possibilities, raises questions concerning the extent to which knowledge of *actual* effects of OCS activities and their comparison with *earlier projections* of what those effects would be is used in the preparation of new environmental impact statements. These questions raise, in turn, further questions concerning the extent to which *actual effects*—social, cultural, cognitive, economic, political, and environmental—have been studied during and subsequent to exploration, production, and termination in areas in which OCS activity is longstanding. In the absence of such corroborative studies, affected communities could well find the projections advanced in impact studies to be at best questionable. Environmental as well as socioeconomic effects are listed here because the publication of an impact statement that advances questionable ecological projections is likely to elicit at least as negative a public response as is the publication of dubious social and economic projections. Impact statements that ignore previous experience and treat the case at hand as if it were the first to be examined are likely to be distrusted by affected parties, and their publication is likely to reinforce general distrust of the institutions responsible for their preparation. Such distrust is justified, of course, for any study that ignores relevant experience of the very agency that authorized it is deficient.

A FRAMEWORK FOR CONSIDERING POTENTIAL EFFECTS

This section considers potential impacts in more specific terms. In addition to a detailed baseline description of particular human environments, the framework for doing this has three elements. It includes, first, activities that can produce impacts and possible reactions to them; second, the dimensions of these impacts; and third, the distribution of these impacts throughout the human environment. Any continuing presentation of potential impacts of particular OCS activities cannot do justice to the complexity of any particular case. The effect of a particular activity in a particular human environment is highly likely to have further impacts. Effects become causes that branch out through ultracomplex systems, but how they do so is to such a degree contingent upon the particulars of each system that general statements by themselves are likely to be meaningless. Although experience gained in one area will always be relevant in others, particular area studies are *always* required. In any instance, the elements constituting the model should be integrated into a systemic analysis.

Activities That Can Affect the Human Environment at Particular Stages in OCS Development

In systems in which information is causal—a class that includes all human systems—the apprehension about events can, as we have already noted, cause effects before their occurrence. Apprehension and forethought are characteristic of adaptive processes and it is, therefore, not surprising that the impacts of OCS leasing invariably commence years before any leasing actually occurs. Should leasing take place and exploration ensue, impacts continue and their scope changes, as they do further if hydrocarbons are discovered and development and production are undertaken, nor is termination without effect. Although impacts obviously vary from region to region depending on the specific characteristics of human and natural environments, it is possible to make some broad generalizations about the effects that are expected at each stage of activity.

Prelease to Early Postlease

Prelease activities include publication of five-year plans, announcements of intention to lease, preparation of supporting documents (EISs, SIDs) and the lease sale itself. Responses to these activities are likely to be widespread and have increased in both intensity and magnitude since the policy of region-wide sales was inaugurated during the Reagan administration. Responses are likely to engage local, county and state governmental agencies, fishing and resort industries, chambers of commerce, coastal real estate interests, citizens' groups, and environmental organizations. The responses are not confined to the locality, for the environmental organizations most active in resisting OCS activities are national. The national public is informed of developments not only by such organizations but also by the national news media. The public in coastal areas distant from the events could consider itself less immediately threatened but read the news as warnings about possibilities in its own future and, consequently, begin to develop attitudes toward development of the outer continental shelf off their own shoreline.

Responses that can commence with such psychological effects as fear and anxiety with publications of five-year plans and that may intensify with announcements of lease sales, include, first, organizing to deal with what is generally taken to be a threat. Organizational efforts may entail

setting up new agencies with substantial payrolls and therefore may include substantial monetary as well as opportunity costs. Activities undertaken by governmental agencies may include legislative, administrative, legal, lobbying, and public relations elements, and environmental and citizens' groups may also engage in public relations, lobbying, and legal action as well as electoral politics and direct action (e.g., demonstrations). While apparently there have been no cases of civil disobedience with respect to OCS development, it has occurred in opposition to nuclear development, and the rhetoric of active, forceful, and even armed opposition to OCS development was used in both Mendocino County, California (which barred the president's task force from even holding a hearing within its boundaries) and southern Florida (where the task force was met by large and hostile demonstrations in both Miami and Key West).

It is of interest that, outside the Gulf of Mexico, local, state, and regional reactions anticipating OCS development have been predominantly negative if not downright hostile. Some of the reasons for this will be addressed below in "Distribution of Effects." It should be noted that resistance to development, mobilized in response to MMS prelease OCS activities, has impacts on MMS itself. For one thing, its Environmental Studies Program has become driven by the requirements of litigation rather than by the need for scientifically adequate information. Moreover, the impacts are not confined to MMS or even DOI. In the absence of effective procedural means for postponing or canceling lease sales, Congress has routinely intervened in OCS activities by imposing moratoria. Congress is thus affected, for demands are made on its time and attention, and its ultimate authority is, misused when it is continuously invoked in what should be routine procedural matters. When issues that should be decided on ecological, economic, and social grounds are passed to Congress for decisions, they become vulnerable to decision in terms of political considerations, that is in terms of considerations having little to do with either regional ecology or the nation's energy needs. To the extent that a decision is made on political grounds it is likely to be a poor one, or, at best, right for the wrong reasons.

It is plausible to argue that there will always be at least a residue of differences of opinion about and interest in OCS activity. It nevertheless seems that the conflict that has characterized OCS development almost everywhere it has even been contemplated both grows out of and nurtures a deep public distrust of MMS, DOI and, through them, the federal government as a whole, not to mention the oil industry and, through it "big business" generally. This distrust, and the anger and alienation related to it, must be counted among the impacts of OCS activities, and they probably reach their fullest expression during the prelease phase.

Some degree of public distrust is probably an unavoidable consequence of conflicting interests, but much of it may be engendered by EISs that the public believes to present unduly optimistic risk estimates. MMS is in a seriously vulnerable position in this regard because it has not studied the actual effects of its own previous activities, much less brought them into consideration in the preparation of new EISs. It could be argued that the public is being no more than prudent in distrusting the products of an agency that has not evidenced an ability to learn from its own experience.

A further product of this distrust and the lack of substantial information concerning actual effects that, in part, grounds that distrust, perhaps combined further with the generally held belief that a decision to lease is a decision to produce, is an escalation of issues from objective matters of economic and ecological costs, risks, and benefits to matters of high principle. As discussed above, matters of high principle are more difficult to adjudicate than are objective concerns and their defense may seem to their partisans to legitimize actions otherwise outside acceptable bounds. Such escalation already characterizes resistance to OCS development in California and Florida, and perhaps other areas as well. It is to be counted among prelease impacts.

Responses that immediately follow lease sales but that precede exploration need to be studied.

Some change in the activities of local, state, and other organizations and agencies may be expected, and it is plausible to argue that apprehension will intensify, particularly in response to outside events. Thus, for instance, when, sometime after lease sale 92 at the mouth of Bristol Bay, Alaska, the *Exxon Valdez* ruptured in Prince William Sound, the Yupik-speaking Eskimo living on the shores of Bristol Bay became deeply alarmed, for the fear of a spill was no longer abstract. Because their coastline is largely wetland rather than cliff, the result of a spill, they believe, would be more damaging than the Prince William Sound event. It would, in their view, be so devastating to the resources that cultural reproduction would be impossible. It would, they think, constitute ethnicide. Spills are not, of course, preproduction impacts, but fear of them is. Continuing fear that the world that their ancestors have occupied for thousands of years is at risk for the benefit of distant interests is a pervasive aspect of the lives of the residents of Bristol Bay, as is their profound anger and resulting sense of alienation from the larger society.

Exploration

During exploration, processes set in motion during the previous phase continue, with some, possibly, attenuating, while others intensify. During this phase, however, events begin to overtake expectations. Actual occurrences do not necessarily reduce apprehensions about the future but can, rather, provide them with new justification. On the one hand, more or less observable day-to-day developments come to serve as concrete data for continuous interpretation of what they may bode for the future. "Overinterpretation," both positive and negative, is likely during this period as a response of more sensitive or engaged members of the community to what may be an innate cognitive drive to reduce uncertainty about consequential matters. On the other hand, the transformation, through time, of the novel and invasive into the routine and integrated may lull the interpretive drive of others into quiescence or, to put it a little differently, may favor interpretations of the future as benign. Conflicting interpretations, each standing on what the interpreters are likely to take to be the increased certainty that is naturally to be derived from actual experience, may well increase political activity and conflict.

At the same time, direct physical and social impacts begin. The introduction of exploration vessels into the area may, for instance, result in competition for docking space, for space on what have been fishing grounds exclusively and, eventually, even for shipping lanes. This stage also sees the beginning of the population growth and economic changes associated with the project. Exploration is both capital-and labor-intensive and this early activity can alter the social and economic characteristics of the area considerably. If immigration is considerable, municipal facilities may become strained and anxieties about increasing tax burdens may be generated. Conflicts between immigrating workers and inhospitable locals may develop and, less dramatically but perhaps more seriously, conflicts between established interests in such industries as tourism, recreation, and fishing and the petroleum industry may become increasingly manifest. As investment in petroleum exploration increases, investment in other industries to which hydrocarbon development may be inimical may decrease.

Finally, with the onset of exploratory drilling, blowouts become possible.

Development

OCS activity reaches its maximum during the development stage. Onshore facilities are enlarged or constructed anew at this time and employment, usually with a concomitant immigration of

a substantial proportion of the OCS labor force, also peaks. Purchases of goods for the project increases and, depending on the area's pre-existing facilities, these purchases may have a significant effect on the local economy. Indeed, in some instances the local community may turn into a boom-town, manifesting all of the tensions and problems characteristic of such places.

Whether or not the full range of boom-town features materialize, OCS activities during the development stage do have the potential to transform the social and cultural characteristics of the community for reasons beyond the obvious influx of new and perhaps subculturally distinct workers, infusions of money into some sectors of the community, new strains on existing structures and services, and so on. Less obvious but, in the long run, possibly more profound: A large development presents opportunities and imposes constraints on community and individual choices that previously did not exist. For individuals the decision may now be between taking high-paying jobs in the hydrocarbon industry and continuing one's high school education, or going on to college. Communities may not have had a decisive, or even very significant voice in the decision to develop, but once the decision to extract OCS hydrocarbons has been made, decisions to develop other industries, such as tourism, may be effectively precluded.

Such decisions not only have opportunity costs but may also result in what Freudenburg and Gramling (1992) have called "overadaptation" and others (Bateson, 1972; Rappaport, 1977, 1979; Slobodkin and Rapoport, 1974) have characterized as "loss of adaptive flexibility." The individual or community so specializes itself that it finds it difficult or impossible to adapt to changed circumstances—such as the disappearance of an industry—that are inevitable for those industries that are based on the extinction of nonrenewable resources. Some Louisiana coastal communities, for instance, Morgan City, which were heavily engaged in the support of inner continental shelf activities, provide classic examples of the process. It is worth noting that overadaptation or loss of adaptive flexibility could well account for the extinction of most of the species that have disappeared from the earth.

Production

During production, the preponderance of OCS activities begins to shift from the field itself to processing areas. Production is technology-and capital- rather than labor-intensive, and local employment is likely to drop during this phase from its peak during development. Moreover, the production economy is an enclave economy. The Gulf of Mexico aside, operating rigs are likely to be manned by employees from outside the locality who fly in for two-week shifts and fly out for breaks. Onshore facilities obviously vary with the amount and type of product extracted. Gas comes ashore in pipelines, but the onshore facilities do not require large numbers of employees. Oil can be brought to shore by either pipeline or tanker. If it is brought to shore in tankers it may be landed for processing outside the production area altogether. This may spare the locality an undesirable shore facility but it also reduces the contribution that the hydrocarbon industry makes to the local economy.

In sum, the contribution of OCS activity to the economies of local areas is likely to reach its peak during the development phase. It is then that employment is highest and that the largest sums of money are disbursed locally for services and supplies as well as for wages. It is then, consequently, that the local multiplier effect of the industry's expenditures is highest. Less money is likely to be disbursed locally during production and local employment declines, leaving perhaps significant unemployment. Suppliers of goods and services who have expanded to meet the needs of OCS development might need to contract. In short, if development generates boom characteristics in the towns or regions in which it occurs, a bust can begin with production.

It is obvious that production constitutes the ground for the full realization of conflicts over

space use and other matters, such as air and water pollution and between oil and gas producers and other interests, and with production the likelihood of spills becomes much higher than during earlier periods, when it is very low. The magnitude of the hazard also becomes much greater. These risks are very difficult to calculate but do depend to some degree on the means chosen to store extracted gas or oil in the field and to bring them ashore. Although pipelines can leak, tankers are more likely to.

It might be obvious but it should nevertheless be made explicit that these brief outlines of likely impacts of development and production propose *entailments* of these two types of activities. It is unlikely that so stark a contrast will be realized so clearly or abruptly in the actual history of any region because the two phases are not likely to be temporally distinct. Exploration and development can continue even after production is well under way, and even after some production platforms are no longer in use.

Termination

The process of termination itself requires more and different labor from that employed in production, and employment rates may rise in the short run while it is taking place. The effect of this increased labor demand on local unemployment rates, short-run at best, may further be minimized by the employment of experienced workers from outside the area.

To the extent that the economic and social characteristics of regions have been shaped by the petroleum industry, its phasing out and ultimate disappearance will cause further difficulties, and their solutions may be hampered by overadapted labor forces and landscapes that have been polluted and transformed by large onshore facilities that become increasingly unsightly as they fall into disrepair. It is not only that an important part of the economic base has disappeared, but its disappearance has left in it wake conditions that may hinder alternative uses and repel those who might invest in their development. Investment in the development of other industries may also be hindered because there is likely to remain, even after termination, considerable uncertainty concerning the future of gas or oil extraction in the area. Termination is not generally a consequence of wells running dry but of their becoming unprofitable under prevailing or foreseeable technological, pricing, and competitive conditions. Given increasing scarcity of gas and oil, and given the likely developments in technology with consequent radical changes in costs and revenues, shut-in fields could be brought back into production on relatively short notice. Continuing uncertainty thus compounds other difficulties that are the legacy of hydrocarbon production.

Dimensions

OCS activities can, as discussed above, affect not only the physical features of human environments but also their demographic, economic, political, social and cultural processes. These effects are likely to be extraordinarily complex for several related reasons.

First, primary impacts such as the influx of workers, produce secondary impacts, such as strains on municipal infrastructures, interethnic tensions, increase in certain forms of crime, windfalls for suppliers of certain goods and services, realignments of real estate values, and increases in the anxiety levels of long-term residents.

Second, various primary and secondary effects can operate synergistically not only to intensify each other but to produce further effects.

Third, human systems are not inert masses capable of remaining passive while they are being

shaped by outside forces. Like all living systems, people and their communities respond to these effects and their responses can be diverse and difficult or impossible to predict. These responses may have impacts on the program or agency impacting them, but not only on them, and "counter-impacts" are not likely to be confined to the region of development. As was argued above, for instance, the *Exxon Valdez* disaster, subsequently reinforced by the *Mega Borg* and Staten Island spills, might have inoculated populations of the entire American coast against OCS development.

Fourth, impacts—and this is especially the case in the class of impacts labelled here "responses"—are always, in some considerable degree, culturally and even subculturally relative.

All of these considerations join to underlie the need not only for intensive and detailed studies of particular aspects of the human environment in each region under consideration for lease sales but for their integration into comprehensive analyses. These studies should not, of course, be limited to listing possible impacts but should attempt, to the degree possible, estimate what may be called their "dimensions." Such estimates must be based on the best information available, including previous experience in other areas and analogous cases from other industries where it is applicable, and may dictate changes in the phases of OCS activities at which the requisite studies are undertaken.

There are several dimensions. The list presented here is, to some degree, arbitrary and overlapping and may be incomplete.

Likelihood

The likelihood of an event's occurring is most tangible for physical events, especially spills. These are uppermost in the minds of the public. Risk estimates, if they are to earn the respect of the public taking itself to be at risk, must be grounded in experience, and these grounds must be made public. In the absence of experience one does not operate in the world of probability but of uncertainty. Whereas risk can properly be expressed in numerical terms, uncertainty cannot, and to represent uncertainty as probability is to invite distrust, which constitutes a serious impact in its own right.

Although the likelihood of disaster may be uppermost in the public mind, uncertainty and probability also surround other aspects of development. There is, for instance, an effect on the market for beach front property of uncertainty about the location and nature of onshore facilities. The differences between tanker spills, earthquake-related blowouts, and the location of onshore facilities makes it clear that we can identify two classes of uncertainty: "essential uncertainty," which cannot be reduced because there might not be any way to obtain the data requisite to estimate probabilities (earthquakes 20 years in the future, for example) and "contingent uncertainty," which can be reduced by a decision or action (locating a shore facility).

One complication must be noted here. Uncertainty is not only a characteristic of some possible impacts. It itself is an impact in its own right, with consequences as concrete as decisions not to invest in real estate and as intangible as continuing feelings of anxiety and anger. As an impact, uncertainty itself has a probability that approaches 1.0.

Magnitude

Some impacts are highly likely but not very consequential. Others are unlikely but very severe. The magnitude of impacts is in some degree independent of their likelihood and the two must be conceived and approached separately, at least in the beginning.

No single metric is in itself adequate for the estimation of magnitude. Monetary values can

be plausibly estimated for some but not all forms of impact. Employment rates, health statistics, cultural consequences, number of people affected, duration of effects, and reversibility of effects are all aspects of magnitude, some of which are not plausibly metrical although very real.

Space

Magnitude has spatial aspects. There is, first, a continuum between concentration and diffuseness but the two are not mutually exclusive. The *Exxon Valdez* disaster had a concentrated effect on more than 1,000 miles of coastal Alaska and the on livelihoods and ways of life of people living in that region. It had more diffuse effects throughout the United States and even, with some attenuation, in other parts of the world, with some increase in focus in areas like southwestern Florida, the northern and southern California coasts and New England—all of which were especially sensitive because they were facing lease sales. There were obviously impacts on New York and Houston, where Exxon's headquarters are located, and so on. The magnitude of impacts may be widely dispersed in this era of instant communication and social amplification must be considered in its assessment.

Time

There are several temporal aspects of impacts, two of which are noted here. There is, first, as already noted under magnitude above, the matter of duration, occurring on a continuum from evanescent to everlasting. Second, some effects are continuous, perhaps rising and falling through time; others are intermittent. In cases in which possible effects are intermittent there are the further questions of whether periodicity is regular or irregular, and what the frequencies are.

Cumulative Potential

Some impacts pass away leaving, soon after their termination, few if any marks of their occurrence (e.g., the impact of exploration that has not succeeded in discovering gas or oil, for example); the effects of other activities can accumulate. This is obviously the case for some physical events (oil deposition in wetland fish spawning grounds), but also can be characteristic of more purely sociocultural impacts. Thus, the repetition of confrontations between local citizens' groups and government agencies may cumulatively abrade public trust in government.

The effect of accumulation does not always conform to expectations derived from simple arithmetic. For example, the impact of one offshore support vessel working out of a small harbor might be slight; the impact of a second might double it but still be slight. After some increase in the number of vessels, however, qualitative changes can begin. New docks, new fuel delivery routes, and changes in the proportions of persons employed in the petroleum versus the fishing industry and in their consequent places in the local economies and political arena could result.

Susceptibility to Mitigation

Some impacts may be self-limiting and self-correcting. Given enough time, a fishery could recover from the effects of a spill even if no remedial action is taken. Other effects can be offset or

minimized by corrective action and, when they cannot, cash compensation is feasible if not always satisfactory.

On the other hand, in some cases mitigation is not possible. The destruction of wetlands that constitute hatcheries for commercial species may do irremediable harm to commercial, subsistence, and sports fisheries. Compensation can make partial restitution, but cannot restore the ecosystem or a lost way of life, and in some instances such a loss may be inestimable. It has already been noted that the Yupik speaking natives of Bristol Bay, Alaska, believe that a spill in the area's wetlands would be likely to destroy the species on which their subsistence fishing depends. Inasmuch as their culture is, in the main, maintained and reproduced through subsistence activities, such a loss would not be simply a loss of food, which could easily be compensated for, but a loss of the means by which their culture is reproduced, which could not be compensated or otherwise mitigated.

Distribution of Effects

The benefits and costs of OCS development are never shared equally by all elements of any human system. There are almost always some who benefit and others who are harmed. Some inequities resulting from OCS development are obvious. Those who derive livelihoods by providing support to OCS activities with goods and services obviously benefit, as do the previously unemployed who find jobs in the offshore fields or in onshore support and those who, although previously employed, find higher-paying jobs in the petroleum industry. Losers can include coastal industries that are more or less incompatible with oil production: the resort industry, for one, and also, perhaps, the fishing industry. Also among the losers are other employers who, unable to pay competitive wages, must either suspend operations or go out of business. An instance of such circumstances is provided by Alaska's experience when Exxon paid extremely high hourly rates for unskilled labor in its attempt to clean shorelines following the *Exxon Valdez* spill. Somewhat less obviously, entire communities can lose if OCS development is temporary and results in radical declines in employment and leaves behind rusting and crumbling shore facilities.

Within communities there are further inequities that, although consequences of OCS development, are not necessarily entailed by them. Gramling (1980), for instance, found that white males have benefitted disproportionately from the increasing employment associated with the growth of OCS activities in the northern Gulf of Mexico. The possibility of inequities among the benefits and burdens suffered or enjoyed by different classes, ages, sexes, races, and other sectors of communities in the vicinity of OCS activities will always vary in some degree from case to case and must always be studied. Explicit mention needs also to be made of questions of intergenerational equity. These questions may be ethical rather than political, legal, or strictly economic questions because future generations are obviously not on hand to contest the rate at which resources are extracted, the environment contaminated, and the landscape scarred.

Inequities are not confined to a region. The environmental risks and the social, economic, political, and cultural stresses attending OCS activity are largely borne within the region of development, whereas much of the benefit of OCS activity and the hydrocarbons produced by it accrues to the national system. This understanding does have some merit. "Warrilow's Law" (proposed by Christopher Warrilow with respect to open pit mining in Papua New Guinea), states that the distribution of the benefits of large scale mineral extraction is inversely proportional to distance from it, whereas the distribution of its costs and damages is directly proportional to proximity to it. But the easy and vague assumptions that the national system accrues only benefits while costs and damages are largely confined to the area of development and that it is the national system as a whole, rather than particular components of the national system, that benefit, cannot be left unquestioned. It

can be argued that the national system not only benefits but suffers costs in relation to most OCS developments. These may include endangerment of fisheries, resulting in higher seafood prices for consumers, cost to the federal government of environmental cleanup, a reduction in public or legislative pressure to find alternative ways to meet long-term energy needs, and alienation of citizens in immediately affected areas. It is furthermore not sufficient merely to assume that the benefits of OCS development are simply diffused throughout the national system in the form of less expensive and more reliable fuel supplies and enhanced national security. It is plausible to suppose that, in addition to such diffuse general benefits, more concentrated and significant benefits accrue to certain elements in the national system, especially oil and gas producers. Whether or not—or at least to what extent—such suppositions conform to the facts is not the point here. The point is that the distribution of benefits and costs outside as well as inside the region of development are matters for research and analysis and not for supposition or assumption.

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Appendix C

THE EVOLUTION OF THE FEDERAL OCS PROGRAM: NATIONAL AND REGIONAL PERSPECTIVES

by B. Cicin-Sain, R. Gramling, R. Johnson, and C. Wolf

The development of oil and gas resources found in the federally controlled outer continental shelf (OCS) of the United States has, since its inception in 1954, yielded significant national benefits—the provision of energy supplies, positive contributions to the balance of payments, contributions to the federal treasury, and the generation of jobs and other economic activity. At the same time, the federal offshore oil and gas development program has been marked by extensive and recurrent intergovernmental controversy that has significantly influenced the course of the OCS program and, in the late 1980s and early 1990s, has in effect halted the expansion of the program.

To understand the status of the OCS program, it is important to understand its historical context—the evolution of the program since the 1940s, when the federal government first asserted a role in the development of the outer continental shelf. This appendix first provides a national overview of the evolution of federal offshore oil and gas policy and the conflicts that have accompanied it. It then examines the course of offshore oil development in the regions of the United States where OCS development has either taken place or been proposed—the Gulf of Mexico; Alaska; California; Oregon and Washington; and the Atlantic. This section concludes with observations about the factors that have either facilitated or impeded the program's progress in the various regions.

NATIONAL OVERVIEW

The importance of the OCS program is difficult to overestimate. Since the mid-1970s, 8-10% of total domestic production of crude oil, and 20-25% of domestic natural gas production have come from the OCS leasing program (Manuel, 1984; MMS, 1989, 1991).

In addition to constituting a major portion of production for domestic use, OCS oil and gas revenues contribute significantly to the U.S. treasury; they are the fourth largest source of federal revenue, after personal income taxes, social insurance receipts, and corporate income taxes. The federal government has received more than $100 billion from OCS activity during the life of the program (MMS, 1992).

Offshore oil and gas development also generate significant economic activity by creating new

jobs and stimulating existing enterprises to meet the need for materials for the exploration, development, and production of oil and gas. For example, the Minerals Management Service (MMS) of the Department of the Interior estimates that in the Gulf of Mexico (where most of the OCS development has occurred) some 130,000 jobs depend directly or indirectly on the program; in southern California (the only other site of current OCS development), 40,000 to 60,000 jobs depend directly or indirectly on the program (MMS, 1988, 1989, 1991).

Notwithstanding such obvious benefits, the development of offshore oil and gas resources in the United States has been marked by extensive and recurrent conflict between the federal government and the affected states and localities. These conflicts, which began in the 1940s, have involved questions of resource ownership, of management control, of spillover effects on adjacent communities, and of the distribution of benefits (Cicin-Sain and Knecht, 1987).

Together with other influences—the status of world energy supply and demand, the actions of the oil industry, the orientations of various U.S. administrations, the patterns of public consumption of energy resources, and public attitudes toward the environment—these conflicts have molded the nature, shape, and pace of the federal offshore oil program. To explore the forces that have affected the evolution of the federal OCS program, we begin with a brief history.

Historical Overview

The first offshore oil and gas development in the United States took place in 1897 off the south-central coast of California (in Summerland) from a wooden pier that extended into the Pacific Ocean. The success of this first attempt brought quick emulation, and by 1902 a photograph of the Summerland development "at its peak" shows more than 40 derricks on piers over the Pacific (Lankford, 1971).

The second push for overwater drilling took place at Caddo Lake, southeast of Shreveport, Louisiana, beginning in 1910. The Caddo Lake development required the solving of several technical problems, which were to have later implications for the move offshore into the Gulf of Mexico. First, the pressures were beyond anything encountered before, and many of the early wells blew out, caught fire, and burned uncontrollably. The movement into the Caddo field and subsequently into the deeper, and higher pressure fields common to the Gulf coast, was quickly followed by the emergence of increasingly reliable blowout preventers (see especially Brantly, 1971). A second requirement of the Caddo development was the ability to drill and produce without direct connection to land, although the initial exploration and development was little more than creative use of existing land-based drilling techniques. Platforms were constructed on pilings driven into the lake bottom, and drilling equipment was taken by barge to the site. Finally, another technological innovation, an underwater pipeline connecting the production wells to one of four gathering stations on the lake, was a precursor of the collection lines now used offshore.

This technology surged ahead in 1924 with the development of the Maracaibo field, one of the largest in the Western Hemisphere, ultimately producing about 4.6 billion barrels of oil (Lankford, 1971). Lake Maracaibo in northern Venezuela differed from Caddo Lake in three important ways. First, it is larger, approximately two-thirds the size of Lake Erie. Second, it is up to 120 feet deep. Finally, it is connected to salt water. This last characteristic required the first modification in drilling practices when in 1924 Lago Petroleum Company brought in the first well over water in Lake Maracaibo. The problem was the teredo, or shipworm, a marine mollusc that thrives in the brackish water of the lake and that destroyed pilings in six to eight months. This forced a movement to alternative materials, eventually leading to concrete pilings and steel decks for marine platforms. Finally, the frequent drilling in Lake Maracaibo led to the use of the steam drilling barge.

The derrick was still mounted on the platform but the engines and machinery for drilling were mounted on a barge that could be moved easily from platform to platform. This increased mobility led to considerable savings, and provided a model for the drilling tenders first used in the shallow waters of the Gulf of Mexico.

An additional breakthrough came in 1933 with introduction by the Texas Company (later to become Texaco) of the submersible drilling barge. The barge could be towed to a site and sunk to provide a stable base for the drilling rig, which was mounted on the barge. Once drilling was complete, the barge could be raised and moved to a new location. The drilling barge eliminated the sunk cost of platform construction for exploratory drilling, and was a prototype for the mobile drilling rigs that came into use in the 1950s and 1960s.

Offshore development continued through the 1930s and 1940s in near-shore state waters in California and Louisiana. The state of California first began issuing leases in 1929, and Louisiana began issuing leases for near-shore waters in 1936.

Before 1940, both the federal government and the coastal states assumed that the states owned any oil and gas deposits in the submerged "tidelands" adjacent to their coasts as a remnant of the jurisdiction of the original 13 colonies over the marginal sea (Miller, 1984). However, with the discovery of significant oil and gas resources and given the growing economic importance of these resources, in the 1940s the federal government began to assert its own claims to resource ownership.

In September 1945, President Harry S Truman issued a proclamation asserting U.S. jurisdiction over continental shelf resources (Executive Order 9633, *Federal Register* 12304 (1945); 59 Stat. 885). In administrative action in 1937 and in a 1945 landmark suit brought to the Supreme Court, *United States v. California*, the federal government argued that because the territorial sea concept of the marginal sea did not arise until after the American Revolution, there were no existing property rights for the states to succeed to at the time of independence (Miller, 1984). In 1947, the Court surprised many observers by handing down its decision that the federal government required "paramount rights" in coastal waters to fulfill its responsibilities to the nation as a whole for foreign policy, national security, and interstate commerce and that it was impossible to split the resource questions from these broader issues (*United States v. California*, 332 U.S. 19 (1947)).

The coastal states and ultimately the Congress reacted sharply to the Supreme Court decision and, in 1952, ownership of the submerged lands became a prominent issue in the presidential election, with Dwight D. Eisenhower supporting the case of the states. The compromise finally attained through congressional action in 1953 was a strict division of authority between federal and state governments, and the Submerged Lands Act of 1953 (43 U.S.C. §§1301-1315) gave the states title to the submerged lands and resources of the territorial sea (then to three miles offshore), including "the right and power to manage, lease, develop, and use" them. The Outer Continental Shelf Lands Act (OCSLA) of 1953 (43 U.S.C. §§1331-1356) established that the "subsoil and seabed of the outer continental shelf appertain to the United States and are subject to its jurisdiction, control, and power of disposition." OCSLA was a brief and general law that gave the federal government (through the secretary of the interior) the mandate to lease offshore lands to the highest bidders in the petroleum industry with few conditions or strings attached. OCSLA generally followed the Truman proclamation of 1945 in affirming the rights of the United States to the natural resources of the continental shelf, while stating that the character of the superadjacent waters remained unchanged with regard to fishing and navigation rights (Mangone, 1977).

It became clear that substantial amounts of oil and gas existed in the Gulf of Mexico, probably off the coasts of California and Alaska, and perhaps off the East Coast as well. The coastal states individually and in groups sued the federal government to extend state boundaries. All efforts failed except for those of Florida and Texas. The Supreme Court ruled that in these two cases, the preadmission boundaries of about nine nautical miles had been approved by the U.S. government on

admission of these states into the Union (*United States v. Florida et al.*, 363 U.S. 121 (1960) and *United States v. Louisiana et al.*, 363 U.S. 1 (1960)).

Conflicts over resource ownership were settled, at least temporarily, with the enactment of the two laws in 1953. Discussion of the questions of ownership and management of offshore resources was reopened briefly after the December 1988 proclamation by President Ronald W. Reagan extending the U.S. territorial sea from 3 to 12 miles offshore, in accordance with the practice established of most other nations. However, in the 1990 reauthorization of the Coastal Zone Management Act (16 U.S.C. §§1451-1464), Congress amended the definition of "coastal zone." Section 1543 of Title 16 of the U.S. Code had previously defined "coastal zone" as extending "seaward to the outer limit of the United States territorial sea." The 1990 amendment changed that definition to provide that the zone extends "seaward to the outer limit of State title and ownership under the Submerged Lands Act." This clarification was part of a package of amendments in the reauthorization bill that had the effect of increasing the management authority of the coastal states, through the consistency process, over federally conducted or licensed activities outside the coastal zone that affect "any land or water use or natural resource of the coastal zone" (16 U.S.C. §1456(c)).

Federal Leasing, 1954-1978

The first federal lease sale of OCS rights occurred for the Gulf of Mexico in 1954, the year after the passage of OCSLA. From that point, with a few exceptions, lease sales have occurred at least annually in the Gulf (and usually two or three times a year). Federal waters off the coasts of Florida, California, and Oregon and Washington were gradually added to the program, and there were lease sales in these areas in 1959, 1963, and 1964, respectively (MMS, 1986, 1989). With these expansions the Department of the Interior began to meet resistance to its leasing program.

The rapid momentum in federal leasing that characterized the 1960s came to an abrupt halt in 1969 in the aftermath of the Santa Barbara, California, oil spill. On Jan. 29, 1969, Union Oil's Platform A in the Santa Barbara Channel blew out and some 3 million gallons of oil spewed forth to affect a 660-square-mile area and more than 150 miles of coastline, killing birds and other marine life (Nash et al., 1972).

The Santa Barbara oil spill proved a catalytic event in the rise of the environmental movement. Images of the extensive damage to beautiful beach areas, the plight of seabirds covered with oil, the dead marine life—widely transmitted through the extensive media coverage the event received—contributed to a growing awareness that resource development could pose a serious threat to the environment. An immediate effect of the spill was the postponement of additional lease sales in the Pacific region for five years; initial sales in the Atlantic and Alaska regions also were put off. Moreover, partly as a result of the spill, the 1970s were to see the enactment of several major actions aimed at regulating and protecting the environment, particularly ocean and coastal resources. These actions significantly affected the operation of the OCS program. They included the National Environmental Policy Act of 1969 (42 U.S.C. §§4321-4347), the Coastal Zone Management Act of 1972, the Marine Mammal Protection Act of 1972 (16 U.S.C. §§1361-1407, 50 CFR 216), the Clean Air Act of 1972, the Clean Water Act of 1972, the Marine Protection, Research and Sanctuaries Act of 1972 (33 U.S.C. §§1401-1445; P.L. 92-352), the Endangered Species Act of 1973 (16 U.S.C. §§1531-1543, 50 CFR 17), the Fishery Conservation and Management Act of 1976, and the OCSLA amendments of 1978 (43 U.S.C. §§1801-1866).

For energy questions, however, the situation was to significantly change again in the mid-1970s as new pressures for accelerated development of the outer continental shelf were prompted by the oil embargoes of 1973 and 1974. The embargoes resulted in significant shortages and long lines at gasoline pumps for U.S. consumers and in a dramatic rise in the price of crude oil. From

October 1973 to January 1974 the price of Arabian light crude oil increased from $5.12 to $11.65 per barrel. This increase came on top of a doubling of the price from $2.59 per barrel in January 1973 (Darmstadter and Landsberg, 1976; *Oil and Gas Journal*, 1988). The escalation provided an additional incentive for the exploration and development of the OCS reserves. After the embargoes, President Richard M. Nixon responded to the shortages and price rises with Project Independence, which was to provide the mechanism for increased OCS activity. The plan called for the secretary of the interior to expand the OCS area offered to 10 million acres in 1975 (about triple what had been planned earlier) and to begin lease sales in all frontier areas. In 1975 lease sales resumed for the Pacific OCS; the first lease sales occurred for the Atlantic in 1976 and for Alaska in 1977. The number of acres leased in the Gulf of Mexico in 1975 exceeded that of any previous year (MMS, 1989).

In response to these developments, coastal states, local governments, fishermen, and environmentalists mobilized to amend OCLSA to incorporate more stringent and elaborate environmental review as part of the oil leasing, exploration, and development process. The groups also set out to provide an enhanced role for the states and the public in the decision-making process.

Outer Continental Shelf Lands Act Amendments of 19781

Congress had sought two major goals in amending the 1953 version of OCSLA: to expedite the development of offshore resources and, while doing so, to protect the marine, coastal, and human environment. The energy crisis and widespread public alarm over blowouts and tanker spills had compelled a general reexamination of the nation's energy policy and its program for developing offshore oil and gas resources. By the mid-1970s almost 50% of the oil consumed in the United States came from foreign sources; 36% came from the Middle East. It was widely believed that this amount of dependence on energy resources from volatile and politically unstable sources made the U.S. economy vulnerable to oil embargoes, reduced what was then a favorable balance of trade, and jeopardized national security. OCS resource estimates encouraged the view that energy independence could be achieved by accelerating OCS production (U.S. Congress, 1977).

Upon examination, the 1953 act looked woefully inadequate to its critics in the Congress for the task of bringing about a dramatic increase in offshore energy production in the 1970s. Coastal states, environmentalists, and the public, in turn, focused attention on the act's lack of environmental planning, standards, and safeguards. The Department of the Interior's preference for large, up-front bonus payments in addition to royalties on production from OCS leases was strongly criticized because this practice was thought to exclude small companies and to reduce competition. Administration of the leasing program was viewed as essentially a closed process involving the secretary of the interior and the oil industry (U.S. Congress, 1977). The 1953 act did not provide a mechanism to remedy the damage caused by OCS development to the states or to communities, which feared they would bear the burden of any expansion in offshore energy production. It also did nothing to compensate other users of ocean space and resources, such as fishermen. The act offered no assistance to state and local governments in planning for, nor did it compensate fishermen for economic loss resulting from, OCS development. Finally, a frequently expressed criticism of the 1953 act was that it was essentially a total delegation of authority for the use of the outer continental shelf to the secretary of the interior.

The Congress intended the OCSLA amendments to address these perceived inadequacies in the 1953 act. To limit the broad discretion allowed the secretary under the earlier Act to manage

[1] This discussion is taken from Cicin-Sain et al. (in preparation).

OCS development, the amendments required a five-year leasing program, which would describe the size, timing, and location of proposed lease sales and prohibit the lease of any area not included in the plan. Alternative bidding methods (in addition to bonus bids and fixed royalties) were authorized and required on an experimental basis. Studies were mandated to assess the effects of OCS projects on the human, marine, and coastal environments. OCS development was divided into four stages: preparation of a five-year lease plan, lease sales, exploration, and development. Separate plans for exploration and development were required. Before conducting lease sales and approving OCS exploration and development plans and projects, the secretary had to consult with the governors of the affected states and accept their recommendations if the secretary found them to be in the national interest. Funds were created for oil spill contingencies and to compensate fishermen for damages and loss of fishing gear due to OCS activities.

Amending OCSLA involved a very protracted and divisive four-year effort in Congress. Environmental and conservation groups, joined by national associations representing state and local governments and fishing interests, supported passage of the legislation. The oil companies, their trade associations, and other business groups generally opposed it. Before January 1977 and the beginning of the Carter administration, the Department of the Interior strongly opposed any effort at reforming OCSLA; but after President Jimmy Carter's inauguration and his appointment of Cecil Andrus as secretary of the interior, the new administration also urged OCS legislative reform.

It should be noted that although the coalition that supported the passage of the amendments (the states and the environmental groups) was successful in achieving a more stringent and elaborate environmental review process for oil leasing, exploration, and development, the gains made by the states in the 1978 amendments were limited. Sections 18 and 19 of OCSLA charge the secretary of the interior with preparing five-year plans for leasing lands on the outer continental shelf and with consulting with the governors of the affected states on the content of these plans as well as of specific plans for development and production. The consultation with the states required by the act, however, is only that—consultation—and the secretary is quite free to override state objections on the grounds of national interest.

Implementing the 1978 Amendments: Conflict and Controversy

Implementation of the 1978 amendments has been fraught with serious controversy, extensive litigation, and circumvention of the decision processes established by OCSLA. Only in the Gulf of Mexico did increased oil activity proceed without incident, largely as a result of the longstanding and powerful presence of the oil industry in that region, which predates the rise of the environmental movement. However, in coastal areas where no oil development had yet taken place (the Northeast, parts of California, Alaska), extensive conflicts resulted that involved state and local interests, fishermen, and environmentalists on one side, and the Department of the Interior and the oil industry on the other.

In 1982, Secretary of the Interior James Watt combined all of the leasing, regulation, and research functions pertaining to the OCS program into the Minerals Management Service (MMS). In 1983, Watt made another change, to allow going areawide leasing on the OCS. This procedure opened entire areas (such as the central portion of the Gulf of Mexico) rather than designated tracts for leasing. This greatly increased the acreage offered for lease.

Areawide leasing was a major element of the increasing conflict between federal agencies and most of the governing bodies of the coastal states (Goldstein, 1982). State pressure was felt nationally, and Congress got into the act.

By the mid-1980s, Congress was regularly limiting which portions of the outer continental shelf could be leased by MMS by attaching stipulations on how funds could be spent to the

Department of the Interior's appropriation bill. The debate intensified until President George Bush in his budget address of January 1989 delayed three controversial sales off Florida and California until a presidential task force (OCS Leasing and Development Task Force, 1990) and the National Academy of Sciences could examine the issues and information available for decision making (NRC, 1989). The National Research Council of the National Academy of Sciences found the information lacking in all three sale areas. Particularly noted as lacking was information required by OCSLA about the effects on the human environment.

On June 26, 1990, President Bush announced a moratorium on lease sales for much of the continental United States until the year 2000. In the same statement, he directed the secretary of the interior to change the federal leasing policy. The secretary was directed to

- collect the information necessary to determine the effects of OCS development, including conducting the studies recommended by the National Academy of Sciences
- more carefully select the areas offered for lease
- prepare legislation that would give states directly affected by OCS activities a greater share of the financial benefits of development and a greater voice in decision making.

Although the Department of the Interior has sent a revenue sharing bill to Congress, it is quite safe to say that, in terms of a greater voice in decision making, increased information collection, and more careful selection of areas to lease, few of the requested changes have been made.

Another significant action in 1990 also affected OCS activities. As described by a secretarial committee on ocean policy of the U.S. Department of Commerce (1978), "The Coastal Zone Management Act is an experiment in federalism. It involves an intricate pattern of intergovernmental relationships and a redistribution of political power among state, federal, local, and regional governments." How far that redistribution went in the case of OCS oil and gas leasing was temporally defined by the five-to-four Supreme Court decision in *Secretary of the Interior v. California*, which held that consistency provisions do not apply to Department of the Interior sales (Eichenberg and Archer, 1987). In the fall of 1990 Congress reauthorized the Coastal Zone Management Act specifically to overturn this decision. Thus, the sociopolitical realities to which consistency was addressed remain and will probably have major implications for the OCS program.

In the fall of 1991, Congress passed the most restrictive appropriations bill yet (as far as limitations on OCS lease sales) for the department. The result of this political conflict has been for all practical purposes to close down the outer continental shelf of most of the continental United States for development.

REGIONAL VARIATIONS

In each of the regions where offshore oil development has either taken place or been proposed (Figs. 1-1 and 1-2 of Socioeconomics Panel report), there have been somewhat different adaptations or reactions by the adjacent local and state communities. In some areas (such as Louisiana), offshore oil activities became an integral part of state and local communities and were warmly received; in others (such as northern California), vehement local opposition preempted lease sales. In still other areas (south-central California), development was accommodated only after protracted and complex negotiations that resulted in the adoption of extensive permit conditions and mitigation measures. Similarly, socioeconomic effects appear to vary according to location, although there are some general patterns of effects associated with each stage of development (prelease, exploration, development, production, termination) that appear to have occurred everywhere.

Here we review various regional experiences with offshore oil development. It is important

to gain some understanding of the apparent effects in various localities and of the dynamics of public responses to them.

Our discussion, however, is hindered by the scarcity of information about the social, economic, and political evolution of offshore oil development throughout the United States and by the lack of studies that compare experiences in various regions. Within these limitations we review three major topics for each large area where OCS development either has taken place or has been proposed (the Gulf of Mexico; Alaska; California; Washington and Oregon; and the Atlantic):

- the nature and extent of OCS development
- public responses to the development
- actual or potential illustrative effects.

By way of clarification, we mean by public responses to OCS development the responses or adaptations of local and state governments or local and state organized groups to OCS activities. On the basis of the data available and from the Socioeconomics Panel's visits to the various regions, it appears that the differences in public responses in various regions around the country are related to the following variables:

- the time period during which the first announcement of a proposed lease sale or actual development occurred
- the physical characteristics of the ocean and the coastal zone in the region
- the socioeconomic and cultural context of the affected localities and states (including their relationship to the environment)
- the extent to which there were other major users of the ocean
- the degree of political mobilization of the affected communities.

Actual or potential illustrative effects are the intended or unintended consequences that are expected to or appear to have accompanied offshore oil development. We emphasize "illustrative effects" and "appear to have accompanied offshore oil development" because there are few systematic studies that have isolated, in a causal manner, the social, economic, and political effects of OCS oil development.

Gulf of Mexico Region

Most of the petroleum products produced from on the OCS have come from the Gulf of Mexico (well over 90% of the oil and about 99% of the gas; MMS, 1989). And most of that production (97.6% of the oil and 88.1% of the gas) has been supported from Louisiana in the central region of the Gulf (MMS, 1989). Because most OCS development in the United States has occurred off of, or has been supported from, the central and western Gulf, particularly Louisiana, the discussion of the Gulf will be broken into two sections, the central and western Gulf (primarily Louisiana, but also Texas, to provide an example of extended effects), and Florida (which has taken a different position on OCS development from that of the other states in the region).

Central and Western Gulf

Nature and Extent of Development

Although development in protected waters contiguous to the Gulf began in the 1920s and

early 1930s, the initial exploration and development amounted to little more than creative use of existing land-based drilling technology. Pilings were driven into the seabed, a platform was constructed, and drilling equipment was taken by barge to the site. As interest in deeper prospects grew, these techniques became too expensive; the nonrecoverable cost of platform construction (which became considerable in deeper water and with exposure to larger waves) was constant, regardless of the outcome of the drilling. The 1933 creation of the drilling barge pointed the way for the movement offshore. Although the Texas Company's barge was designed for use in protected inland waters, by the mid-1950s marine drilling barges were working in the shallow Gulf (Brantly, 1971; Stallings, 1984).

Because its leaders saw the potential of the Gulf waters for petroleum extraction, the state of Louisiana in 1936 created the State Mineral Board, which was directed to competitively lease the waters adjacent to the state. The claims of the various states and the federal government concerning the ownership and jurisdiction of submerged lands led to the Truman proclamation of 1945, which asserted federal rights to submerged lands. Despite the proclamation, in the absence of clear legal precedent, Louisiana (and Texas, which soon followed) continued to lease offshore lands, including those later defined as part of the OCS (Mead et al., 1985). The first exploratory drilling on what is now the OCS was carried out in 1946 by Magnolia Petroleum Company southeast of Eugene Island, Louisiana, six miles from land.

The first federal OCS lease sale was held in the Gulf of Mexico in October 1954 (MMS, 1989). In all, 394,721 acres were leased and the federal government received cash bonuses of more than $116 million. A second sale was held later that year. From that point, with a few notable exceptions (1956, 1957, 1958, 1961, 1963, 1965), lease sales have occurred at least annually (and usually two or three times a year; Table C-1).

In 1954, 64 new wells were started in Louisiana OCS, most of them as a result of earlier lease sales. By 1964, there were 647, an annual figure that remained fairly constant for the next two decades. The value of OCS production rose similarly. The value of Louisiana OCS oil and natural gas produced in 1954 was about $5.4 million. By 1980, this had risen to more than $11.4 billion (Manuel, 1984).

There have been several incidents or trends that have affected (or failed to affect) OCS activity in the central and western Gulf. First, what did not happen in the Gulf was a slowdown of OCS activity in the aftermath of the 1969 Santa Barbara oil spill. Lease sales in the Pacific were postponed for five years, as were initial sales in the Atlantic and Alaska. In the Gulf, it was business as usual (Table C-1).

Second, the 1973-1974 oil embargo had a massive effect on OCS activity in the Gulf. Two factors directly affected OCS operations in the Gulf. First, the dramatic rise in the price of domestic and foreign crude oil provided an economic incentive for exploration and development, and second, early in 1974 President Nixon offered the country a quick fix in the form of Project Independence, which provided the mechanism for the secretary of the interior to increase the OCS acreage offered for lease and to begin lease sales in all frontier areas. Magnuson and Hollings (1975) noted four problems with the plan:

- Reexamination of the U.S. Geological Survey's overly optimistic estimates of reserves called into question the ability of the OCS tracts to produce not only the quantities needed, but for the length of time required.
- The increased offerings would probably result in fewer dollars per acre for bonus bids for OCS leases.
- Increased effects on coastal areas would result from the increased activities.
- The capacity industry needed to explore the increased acreage (drilling rigs, support vessels) did not exist.

TABLE C-1 OCS Activities in the Gulf of Mexico

Year	Tracts offered	Acres offered	Tracts leased	Acres leased	Total $ bonuses	$ Bonuses per acre	Expl. wells	Developed wells
54	237	860,608	109	461,870	139,735,505	303	3	61
55	210	674,095	121	402,567	108,528,726	270	18	117
56	0	0	0	0	0	NA	41	182
57	0	0	0	0	0	NA	47	282
58	0	0	0	0	0	NA	56	172
59	118	539,813	42	171,300	89,746,992	524	86	213
60	385	1,610,254	147	704,526	282,641,815	401	114	259
61	0	0	0	0	0	NA	110	335
62	830	3,718,115	420	1,929,177	489,481,061	254	148	351
63	0	0	0	0	0	NA	188	357
64	28	34,028	23	32,671	60,340,626	1,847	200	474
65	0	0	0	0	0	NA	169	619
66	70	263,891	41	139,773	188,010,893	1,345	260	596
67	206	971,489	158	744,456	510,079,178	685	287	604
68	195	775,375	126	570,983	743,767,835	1,303	294	651
69	65	190,153	36	108,657	110,945,535	1,021	215	607
70	161	666,845	138	598,510	945,064,773	1,579	201	628
71	18	55,872	11	37,222	96,304,523	2,587	254	556
72	210	970,771	178	826,195	2,251,347,556	2,725	296	545
73	276	1,514,940	187	1,032,570	3,082,462,611	2,985	291	527
74	1,006	5,006,881	356	1,762,158	5,022,860,815	2,850	336	459
75	1,143	5,989,734	265	1,369,828	670,821,011	490	310	517
76	193	942,092	77	337,413	555,125,455	1,645	278	782
77	223	1,074,536	124	605,427	1,170,093,432	1,933	322	851
78	362	1,865,423	206	1,052,467	1,666,298,621	1,583	305	808
79	247	1,166,118	171	812,702	3,160,826,960	3,889	334	753
80	273	1,367,883	183	934,977	4,094,889,184	4,380	349	754
81	421	2,159,295	258	1,308,213	3,893,097,504	2,976	327	808
82	378	1,952,417	171	871,478	1,802,832,942	2,069	372	792
83	13,023	71,153,488	1,040	5,393,997	4,906,889,551	910	378	717
84	20,816	115,413,886	970	5,125,178	2,478,473,398	484	559	710
85	15,754	87,028,709	670	3,529,325	1,542,346,514	437	490	617
86	10,724	58,670,104	142	734,427	187,094,747	255	263	396
87	10,926	31,846,415	640	3,447,825	497,247,006	144	399	416
88	11,282	61,492,451	917	4,829,523	514,083,346	106	550	423
89	11,013	60,097,672	1,049	5,580,867	645,646,870	115	475	501
90	10,459	56,788,766	825	4,263,446	584,301,918	137	451	

Source: MMS, 1991a.

Despite this analysis, increased leasing moved ahead. In the Gulf, acreage sold in 1975 exceeded that of any previous year (MMS, 1989).

It should be noted that movement into many of the "frontier" regions was supported from the Gulf of Mexico. Because of the nature of the concentrated work scheduling associated with offshore employment (workers generally spend 14 days on duty and 14 days off) it is possible for individuals to live at a considerable distance from where they regularly work (Gramling, 1989). In addition, many of the products purchased for offshore exploration and development are inherently mobile, so they can be constructed in any coastal region in the world. Of the five production platforms in place in the Pacific OCS before 1975, two were built in Morgan City, Louisiana (MMS, 1989). Thus, the support sector (both for capital investment and for labor) in the Gulf of Mexico grew throughout the 1970s in response to continued activity in the Gulf, as well as in response to development in frontier OCS areas.

The third factor that has affected OCS activity in the Gulf was the decision by Secretary of the Interior Watt to allow areawide leasing in 1983. This opened up large areas (such as the western Gulf of Mexico) and drastically increased the number of acres and tracts offered for lease in the Gulf. (Prior to areawide leasing the record number of acres offered (Sale 37, February 24, 1975) was 2,870,344, the first areawide sale in the Gulf offered 37,867,762 acres, an increase of 1,219.3%).

The final major factor that has affected Gulf OCS activities is the recent decline in the price of crude oil on the world market. Although the other factors tended to support rapid development and consumption of Gulf resources, the decline in crude oil prices, coupled with declining reserves, has led to massive alterations of activity in the Gulf and a clear recognition of the area's dependence on offshore activities.

Today there are more than 3,800 production platforms in the central and western Gulf. There is no other area of the planet in which OCS activities even approach this extent of development, and there is no other area where the effects of development are as clear.

Public Response

In general, OCS activities in the central and western Gulf have met with ready acceptance by local and regional residents. There are several factors—historical, social, and geographic—which have led to this public response.

Historical Factors. Perhaps the most significant historical factor lies with the sequence of OCS development in Louisiana. Several points are important: First, OCS activity in the Gulf occurred as a gradual extension of land-based gas and oil production through the coastal marshes and into ever deeper federal waters. The initial push toward the Gulf of Mexico came in the early 1920s and 1930s as land-based drilling technology was adapted for drilling in the marshes of southern Louisiana and Texas. After the passage of OCSLA in 1953, the technology evolved rapidly. The evolution of offshore technology was paralleled by the emergence of a support sector and by new forms of work scheduling in answer to the logistical problems of operating at remote sites (Gramling, 1989). By the 1960s, development on the OCS off Louisiana and Texas was well under way—a trend that was exacerbated by the oil embargo of 1973 and 1974.

Most of the history of offshore drilling, and most of the developments that allowed drilling to move into ever more hostile environments, happened in Louisiana and Texas as a gradual extension of land-based practices. Not only was the growth incremental, but it was focused on the solution of local problems for local use, and it was largely isolated from the mainstream economy and industrial

development. Unlike OCS oil and gas production in other regions, it did not appear suddenly, full-blown and threatening to the environment or to the local way of life.

A second historical consideration concerns not just the gradual nature of offshore development in the central and western Gulf, but the period in which it began. The initial development was well under way by the late 1930s. In contrast to the 1970s and 1980s, the period during which most of the opposition to OCS activity took place, the 1930s and 1940s antedated a general environmental awareness; it was an "exuberant" time (Catton and Dunlap, 1980) of nationwide growth and faith in technology. There was little conception of the marsh as a fragile and finite ecosystem. Drilling procedures consisted of the most efficient way to get a job done, often allowing the construction of canals through marshes to allow submersible drilling barges to operate. In this sense, offshore drilling evolved in the Gulf as an environmentally insensitive activity.

These factors contributed to making the central and western Gulf coast in the 1930s and 1940s very different from the rest of the country in the 1970s and 1980s, and to producing a local image of offshore development that is not likely to be repeated in the future.

Social, Economic, and Political Factors. Several social factors affected public response to OCS activities in the central and western Gulf. First, the states of Louisiana and Texas at the time were actively and aggressively marketing the offshore waters for oil production.

Second, at least in coastal Louisiana, the economy was traditionally based on extractive activities. Products for export from the Atchafalaya Basin (cypress lumber, fish, crawfish, moss [for furniture stuffing], water fowl) and from the coastal marsh (furs, shrimp, oysters) were the mainstay of the local economy at the turn of the century (Comeaux, 1972). Oil was simply another extractable resource that emerged in conjunction with more traditional pursuits.

The primary extractive activities in coastal Louisiana prior to World War II were in the coastal marsh and contiguous swamps (Comeaux, 1972). There was no long tradition of offshore fisheries as, for example, exists on the East Coast. In fact, the current major commercial species in the Louisiana Gulf, shrimp, wasn't known to be available in the open Gulf until the 1950s. As a consequence, both offshore activities—oil and gas development and fishing and other types of extraction of renewable resources—grew up together. In fact, early exploration for oil was done from shrimping vessels leased by the oil companies (Morgan City Historical Society, 1960).

Finally, adaptation to OCS activities has affected the public response to them. Through the first OCS lease sale in 1954, spurred on by the oil embargo, and until the 1982 explosion in offshore activities, the support sectors for those activities grew steadily in the Gulf of Mexico. Thus, for over two generations offshore development and support have expanded to become a mainstay of the Louisiana coastal economy, and they are an accepted regional institution.

Geographic Factors. Another factor that leads to the difference between the public response in the central and western Gulf and that of the rest of the country is the geography of the Gulf. In most of the coastal areas of the United States much of the population lives on or near the coast, and virtually all of the coast is accessible by road. In the central and western Gulf very little of the population lives on or near the coast, and with the exception of Galveston, Texas, there is little coastal access by road in the area of most intense OCS development, which stretched from Corpus Christi, Texas, to Mississippi. This is a result of the extensive band of marsh that runs parallel to the coastline, mainly in Louisiana. Because of this, not only are proximity and access different in the Gulf, but perceptions of the coast are radically different. In much of the country the coast is seen as a valuable public resource, a thing of beauty, and a source of popular recreation. In Louisiana, particularly, the coast is rarely visited for recreation, and descriptions are more likely to involve alligators and mosquitos than spectacular scenery.

Nor does the Gulf inspire the type of awe commonly associated with the coast in other parts of the country. The wife of a salmon fisherman wrote concerning the meeting of the Socioeconomics Panel in Fort Bragg, California:

> Did anyone mention the nature of our coast here? We live on a lee shore, our weather comes right from the Gulf of Alaska. It is spectacular but nonetheless common to watch 25 and 30 foot seas break clear across Mendocino Bay as they roll in from thousands of miles of unbroken ocean, driven by the winter storms.

The geography and topography of the area also have led to fewer conflicts over use, particularly compared with the West Coast. Louisiana and Texas are characterized by an abundance of waterways that provide coastal access and docking space. Thus dock space in Louisiana is limited not by a lack of suitable harbors, but by a lack of facilities, a shortage which can be easily remedied by construction. This is not true in California and much of the rest of the country.

Marine use conflicts have been notably absent in the Gulf, not only because of the incremental nature of the growth of offshore oil and gas activities and because of the greater availability of dock space, but also because of the topography of the continental shelf. The continental shelf of the Pacific and the Atlantic slopes much more dramatically into the ocean basin and is much narrower than that in the Gulf. The Gulf has a much larger area available for use, and loss of area is correspondingly less critical than it is along the Atlantic or Pacific coasts. Likewise, because the area available for use is less critical, avoidance of offshore oil and gas installations to loss of fishing gear is less of an issue.

Illustrative Effects

Development of OCS oil and gas in Louisiana has followed a pattern of boom and bust. For the first 40 years, there were new jobs, rapid population growth, and a good deal of change in the social, economic, and physical environment in coastal communities and other centers of offshore support development. All of this created new demands for goods, services, and labor, and put strains on existing transportation networks, community infrastructures, and the delivery of social services.

The communities most affected by the OCS boom were those such as Morgan City, which became a staging area for offshore activities, or Lafayette City, which became a managerial center. Although many parts of the communities were affected, some of the most evident effects occurred as a direct result of the population increases. Between 1940 and 1980 Lafayette City's population grew from 19,210 to 81,861 and that of Lafayette Parish increased from 43,941 to 150,017. These are increases of 327% and 241% respectively; there was a 78% increase for the state and a 72% increase nationwide for the same period (U.S. Bureau of the Census, 1940, 1980). Other affected locations grew at similar (if less dramatic) rates. Housing was in short supply and prices increased as demand exceeded supply. Local services (sewage treatment, water supplies, roads, utilities, recreational facilities, medical facilities, policy departments, schools) remained behind the population growth throughout the 1960s and 1970s (Mumphrey et al., 1977; Stallings et al., 1977; Gramling, 1980, 1983; Gramling and Brabant, 1984, 1986).

News of employment opportunity in coastal Louisiana appeared in national publications during this period, and a transient labor force was attracted for work offshore. The general economic growth attracted significant numbers of the transient, chronically unemployed (Brabant and Gramling, 1985). Labor camps that sold bare necessities (bed, food, and job contacts) for exorbitant prices sprung up in Morgan City, and shelters and agencies that provided basic human services (food, clothing, shelter) often were strained beyond their capacity (Brabant, 1991). Crime rates also

increased: By the mid-1970s, the violent crime rate in Morgan City was two or three times the average rate for U.S. cities of comparable size (Gramling and Joubert, 1977).

By the late 1970s, much of coastal Louisiana exhibited many of the characteristic stresses associated with the classical boomtown syndrome (Albrecht, 1978; Bates, 1978; Gramling and Brabant, 1986). The growth-related problems moderated somewhat with the decline in crude oil prices in 1982. However, when the crash in crude oil prices came in 1986, it became quite clear that growth of the offshore industry had led to a modification of the social, economic, and physical environment, and an entirely new set of problems developed. The crash of world oil markets led to radically reduced OCS activity and to a recognition of the problems associated with extensive adaptation to an extractive activity.

Because extractive enterprises such as OCS development must locate near the resource, they cannot necessarily take advantage of existing concentrations of labor, supplies, or other support, and often must develop these from scratch (Bunker, 1984). This building of the local social, economic, and physical environment to support a particular extractive activity has several consequences. First, the development (social, economic, and physical) surrounding the extractive activity is highly specialized, and often it is not transferable to new forms of economic production. Second, creation of a new support sector can exhaust local resources and capital, precluding or limiting future forms of development. Third, high-paying jobs in the extractive sector can make diversification difficult because enterprises with lower profit margins cannot compete for labor. Finally, extractive economies have a finite life, and they are notoriously susceptible to fluctuations in commodity markets. The first three of these consequences lead to a situation that Freudenburg and Gramling (1992) call "overadaptation," and that others call "loss of adaptive flexibility" (Bateson, 1972; Rappaport, 1977, 1979; Slobodkin and Rapoport, 1974). The last consequence guarantees that overadaptation eventually becomes a problem. Freudenburg and Gramling argue that the problem with development is not that communities fail to adapt, but rather that they will, indeed they cannot fail to, adapt to new specialized conditions and that the adaptation itself becomes a problem. When the extractive activity declines, as it must, the area's economy is more specialized than it was before the activity started, and there are fewer local resources and less capital available.

In addition to replacing the traditional economic activities of long-term residents, the growth associated with offshore development attracts workers to fill jobs in the expanding labor market. Using data available for the past 20 years, it is possible to statistically explain more than 95% of the variance in total employment in several coastal parishes in Louisiana, using only the price of oil on the world market and the world rig count as predictor variables (Gramling and Freudenburg, 1990). Thus, not only have offshore oil and gas activities in coastal Louisiana been around for two generations, but they have come to almost completely dominate the coastal economy.

The region's social and economic systems adapted to the circumstances, and they did so at a variety of levels. Individual workers made career decisions based on the expectation that trends would continue. Seventeen-year-olds dropped out of high school to gain and use (often esoteric) skills in the support and fabrication sectors surrounding offshore activities. Those who graduated frequently pursued specialized skills (associated with the offshore and support sectors) instead of other skills more basic to a diverse, or more flexible higher education.

Small businesses specialized. Mechanics' shops became marine diesel repair facilities (with considerable investment in tools and equipment to make the transition). New specialty businesses opened to take advantage of the growing opportunities (offshore catering services, for example). Both of these phenomena became trends in an economy that grew so fast that good business practices were not necessary for success. Because profit margins were so high, inventory control, billing, and equipment purchases could be marginal, and still enterprises prospered. This too is an adaptation.

Regional adaptation occurred as the interaction between the resources associated with human and social capital—skills; knowledge; experience; teamwork; networks of supply and distribution; and

the physical capital of buildings equipment, and other physical infrastructure—developed over time. Vocational schools shifted their curricula to focus on skills with ready application in the oil business (Gramling and Reilly, 1980), and entirely new occupations arose ("hot shot" drivers, who owned a truck and provided rapid delivery to staging areas of parts and equipment needed offshore). All of these changes, both obvious and subtle, constitute investment of time, skills, or money in a particular activity in a particular sector of the economy.

The central and western Gulf Coast has experienced massive change as a result of OCS activity since 1954. At the time that OCSLA was passed in 1953, coastal Louisiana's economy was primarily based on agriculture (sugar cane, rice, soy beans) and on the extraction of renewable resources (shrimp, fish, crayfish, furs). Lafayette City was the "hub city" of a regional distribution center, and Morgan City was the self-proclaimed shrimp capital of the world (Gramling, 1980, 1983). By 1980 OCS activities dominated the economy of much of coastal Louisiana and Texas, from Galveston to the Mississippi River (Manuel, 1983; Gramling and Brabant, 1984, 1986; Gramling and Freudenburg, 1990), and led to a reorientation of the social and economic environment throughout the region.

Eastern Gulf (Florida)

Nature and Extent of Development

The first OCS lease sale in Florida waters occurred in 1959. Although 23 tracts were leased in the Florida Keys and several exploratory wells were drilled, nothing was found and the leases expired. Leasing resumed off the Florida coast in the 1970s; the primary area of interest has been in the Destin Dome and De Soto Canyon areas off the Florida panhandle. The exception to this general trend happened with Sale 79 (1984) when the new areawide leasing program allowed 73 tracts to be leased in the Charlotte Harbor area, south of the 26th parallel. Florida has generally been cautious concerning OCS activity in general, but these tracts northwest of the Keys have created the greatest controversy. To date, all drilling in Florida has been exploratory, although there are now plans for production off the panhandle.

Public Response

There have been two consistent themes in Florida's communications with the Department of the Interior about OCS development. First, the state government has, through two governors (Bob Graham and Bob Martinez), maintained that it is not opposed to OCS development as long as sufficient consideration is given to Florida's unique coastal environment. Second, the state has maintained at least since 1979 that there is insufficient information to be able to determine impacts from oil and gas activity in the environmentally sensitive and economically important area south of 26°N latitude.

Notwithstanding the state's opposition, offerings south of 26°N latitude did occur during the five-year areawide leasing plan in Sales 79 and 94, and 73 tracts were sold. Although Congress did not delete the area from the sales, congressional appropriations language imposed a moratorium on exploratory drilling until two stipulations were met: First, no exploratory drilling would be approved by the Department of the Interior until 3 years of physical oceanographic and biological research data had been collected. Second, lessees would be required to perform biological surveys prior to drilling and they would be required to work with the department to monitor subsequent drilling.

The issue again arose as the proposed five-year plan for 1987 to 1992, was being developed

and made final. Again citing a lack of information, Governor Bob Martinez recommended to Secretary of the Interior Donald Hodel several deletions, including portions of the area south of 26°N, both before and after the proposed final five-year leasing plan was developed. In addition, on May 5, 1987, Governor Martinez released the draft report of an independent scientific review of MMS's studies of the southwest Florida shelf. The review found that the studies "added a significant body of information regarding the biology and physical oceanography of the shelf off southwest Florida" but it concluded that they "did not provide the type of information nor detail to determine the specific impacts of oil and gas activities on certain sensitive habitats off southwest Florida" (Governor's Office of Planning and Budget, 1987).

OCSLA allows states to request judicial review of the five-year program within 60 days of program approval, and on Aug. 14, 1987, Governor Martinez announced he was requesting such a review. Following a visit to Florida in November by Secretary Hodel, a letter of agreement was signed between Martinez and Hodel on March 24, 1988. In it, Governor Martinez agreed to move to dismiss the petition Florida filed challenging the five-year program (*Martinez et al. v. Department of the Interior*), and Secretary Hodel agreed to exclude portions of the area south of 26°N (and some other areas) from the 1987-92 five-year plan.

In an apparent move to simplify Sale 116 (originally an areawide sale for the eastern Gulf of Mexico), Secretary Hodel informed Governor Martinez on June 15, 1988, that he was dividing Sale 116 into two parts. Part I—consisting of the area north of 26°N latitude and west of 86°W longitude (less excluded areas)—would proceed on schedule. Part II—south of 26°N latitude and east of 86°W longitude—would be delayed for at least six months.

In testimony before the House Appropriations Subcommittee on Interior Feb. 9, 1989, Governor Martinez supported the continuation of the delay of Part II of Sale 116. In his budget address of February 1989, President Bush further postponed Part II, and the area was the subject of study by a presidential task force (along with Sales 91 and 95 off California; OCS Leasing and Development Task Force, 1990) and a review by the National Research Council (NRC, 1989). As a result of that review, the area was placed under a presidential moratorium, and discussions for a federal buyback of the leases are under way.

Illustrative Effects

Actual impacts in Florida have been limited primarily to what Freudenburg and Gramling (1992) call "opportunity-threat" impacts. Unlike biological or physical systems, for which no impacts occur prior to concrete alterations of the physical environment, social systems can be affected by changes in the social environment. Observable, measurable effects begin as soon as there are changes in social conditions, which, in the case of OCS activities, can mean the announcement of a lease sale. Opportunity-threat impacts include those to environmental and health systems, and to economic, social, cultural, and psychological systems (Freudenburg and Gramling, 1992). In Florida these effects included community organizating and political opposition to OCS activities.

Alaska

Nature and Extent of Development

The outer continental shelf in Alaska comprises 74% of the total in the United States; it is 830,000 square miles of a national total of 1.12 million square miles. This predominance stems both

from the length of the Alaska coastline and from the width of the Alaskan continental shelf. Alaska's coastline is 6,640 miles long, 54% of the U.S. total of 12,383 miles. In addition, the Alaska continental shelf is 200 to 300 miles wide. This compares with an average width of 40 miles off the Atlantic Coast, 60 miles in the Gulf of Mexico, and 20 miles off the Pacific Coast.

The U.S. Geological Survey estimates that an undiscovered but recoverable 12.2 billion barrels of oil and 64.6 trillion cubic feet of natural gas lies beneath the outer continental shelf in Alaska. The Department of the Interior considers Alaska OCS development the linchpin of its OCS program (Jones, 1984), and President Bush has referred to OCS reserves in Alaska, along with onshore reserves, as the most promising prospects for discovering major new U.S. oil reserves.

Alaska OCS development also must be considered in the context of other successful oil and gas production in that region. Alask's North Slope oil fields are the twelfth largest in the world and the largest yet discovered in North America. They are estimated to contain more than 10 billion barrels of recoverable oil. The North Slope oil reserves were discovered beneath Prudhoe Bay in 1968, and developed amid considerable controversy, particularly pertaining to oil transport issues. The 800-mile-long Trans-Alaska pipeline was selected as the best transportation method after Congress waived the requirements of the National Environmental Policy Act (42 U.S.C. §§4321-4347). Since 1977, more than 6.7 billion barrles of crude oil has been pumped from Prudhoe Bay to Valdez, Alaska. At Valdez, the oil is loaded onto oil tankers and shipped to terminals and refineries throughout the continental United States (Townsend and Heneman, 1989). MMS estimates that the remaining North Slope reserves are at least 5 billion barrles of oil and 26 trillion cubic feet of gas (MMS, 1989).

The Department of the Interior is exploring the potential for a second, major onshore development in the Arctic National Wildlife Refuge in the far northeastern corner of the state. Oil reserves there are estimated at between 3.2 and 9.2 billion barrels of oil, but the project has engendered enormous opposition because of its potential to harm protected fish and wildlife habitat (Dolan, 1987).

Within the Alaska region there are 15 planning areas consolidated into three subregions. Since 1976, a total of 16 lease sales have been held in the Alaska region. In all, 98 million acres have been offered and 8.1 million acres, in 1,477 tracts, have been leased. As of September 1988, 996 active leases were owned by 41 operators (MMS, 1989). The three most recent lease sales are notable, each for different reasons. The sale of March 1988 in the Beaufort Sea was the first outside of the Gulf of Mexico since 1984. The May 1988 sale of leases in the Chukchi Sea set several new records for the Alaska region, including those for the number of tracts and acres bid on and leased. The Northern Aleutian sale was held in October 1988. However, a congressional moratorium has prevented any exploratory activity on leases from that sale. The 1992 MMS five-year leasing schedule includes eight lease sales for the Alaska region (MMS, 1991b).

Federal exploration in Alaska began in 1975. As of March 1990, 71 exploratory wells had been drilled on the Alaska outer continental shelf, but no development or production has begun (MMS, 1989). Initial interest focused on the northern Gulf of Alaska, where 10 wells were drilled between 1976 and 1978. All were dry. Interest then shifted to Cook Inlet, but the six wells drilled there between 1978 and 1984 also were dry. Industry began to explore the Beaufort Sea, in the Arctic subregion, in 1979. Twenty wells have been drilled in that planning area, and eight were determined by MMS to be producible. Two have been temporarily abandoned, and a third has been permanently abandoned. Exploration continues on the other five, and Shell Oil Company has announced that one of its Beaufort Sea wells on Seal Island could contain commercial quantities of oil. MMS describes these discoveries as "subcommercial" (MMS, 1989), but because of their proximity to Prudhoe Bay, production is economically feasible. Recoverable reserves in this area are estimated at 300 million barrels of oil (MMS, 1989). Three wells were drilled recently in the Chuckchi Sea; however, no information about producibility is available.

In addition to OCS oil and gas exploration, MMS is also considering the potential for recovery of heavy-mineral placers offshore of Alaska. A federal-state coordination team was established in 1988 to examine the resource potential, particularly in Norton Sound, where a lease sale was scheduled for early 1990.

Public Response

Alaska and its outer continental shelf are unique in many respects and these qualities must be kept in mind in the evaluation of the social and economic effects of OCS oil and gas activity and in the explanation of state and local responses. Alaska is the most sparsely populated state in the nation. Its 1989 population of 527,000 is spread over a land area of 365,481,600 acres; the density of 0.89 persons per square mile is the lowest in the nation. Most of the population (64.3%) lives in urban areas. About 17% of the population (91,000) is native, mostly living in small coastal villages where OCS oil activity would have the greatest impact. About 47% of the natives are listed as unemployed, which indicates in part their dependence on subsistence hunting and fishing, which can account for a major part of their diet, sometimes as much as 80%.

Oil is clearly the dominant economic activity in Alaska, providing almost 85% of annual state revenues. In most years, the state pays each citizen a certain sum instead of collecting taxes. Fluctuations in oil prices worldwide have a major effect on the Alaska economy. Dependence on oil revenues gives the oil companies a dominant position in political power in the state.

Alaska has relatively less power in Congress than other coastal states do. Although it has two senators, as do all states, its small population allows it just one member in the House of Representatives. It has distinctly less political clout than states such as California (1989 population 29,063,000, 45 representatives), Texas (1989 population 16,991,000, 27 representatives), and Florida (1989 population 12,671,000, 19 representatives).

Alaska's climate is also a factor. The Bering Sea and many coastal waters are covered with ice for much of the year, posing special technical problems for OCS exploration, drilling, and production. Transportation also is difficult.

Environmental groups throughout the nation have taken a special interest in Alaska, which is distinctly different from the interest they have demonstrated for the Gulf of Mexico—where most of the drilling occurred before the environmental movement became widespread. In many respects environmental groups perceive Alaska as a "national" resource rather than as a resource held by and for the benefit of the residents of Alaska.

Alaska natives deserve special concern with respect to OCS activity because their culture could be at stake if significant changes occur to their environment. Certainly this is a perception held by most coastal natives, and is a possibility according to environmental impact statements. In general, Alaska natives are far more bound to their region than are citizens in other areas. Native Alaskans often lack the employment and cultural mobility enjoyed by nonnatives.

In the past decade, three Alaska governors, Hammond, Sheffield, and Cowper, have consistently raised objections to aspects of the Alaska region OCS oil- and gas-leasing program. The state government generally approves of the OCS program, but has voiced concerns over specific tracts of the lease sales and specific elements of the exploration and drilling plans.

In the early 1980s, Governor Jay Hammond raised serious objections to the Department of the Interior's accelerated leasing program, brought about by areawide leasing. In testimony before Congress, he questioned both the magnitude and the pacing of the OCS program. The state's specific concerns included the inability of the regional MMS office to adequately analyze and process lease sales; inadequate safety technology, particularly in the extreme northern seas; and the potential for

harm to state fisheries. The governor convinced the department to reduce and defer some lease sales. The proposed leasing of tracts in Bristol Bay was dropped.

The state's interests in fisheries of the Bristol Bay region were, in fact, the initial force behind objections to the OCS program, and they remain so. All Alaska governors have denounced oil exploration and drilling activities in that area. After the *Exxon Valdez* spill, the state legislature passed a resolution calling for Congress to impose a moratorium on OCS activity in Bristol Bay. Congress obliged in 1989, and it is now considering a lease buy-back program, pending an MMS study of the region.

Past objections to Alaska Regional OCS activity also focused on the environmental hazards attendant to exploration and drilling in the sea ice covering the Beaufort and Chuckchi seas. The state persuaded the Department of the Interior to include additional oil spill contingency expertise and equipment at exploration and drilling sites in those leases.

State comments on the department's proposed 1992-1997 five-year plan include objections to drilling in the Chukchi Sea; requests for buffer zones in other sensitive areas; a suggestion to establish a biological task force to advise MMS on each lease sale; and an independent panel to review environmental impact statements, additional oil spill contingency planning, and a revenue-sharing program.

Public concern over the oil and gas program has increased over the past decade, and is now at an all-time high. Alaska's citizenry, including commercial and native fishers, object not only to any OCS activity on Bristol Bay, but also to the potential for harm to whales and fisheries from current activity in the Beaufort and Chukchi seas. Various interest groups have organized to participate in administrative processes with relevant agencies, including MMS and the National Marine Fisheries Service, and to lobby Congress for moratoria, studies, and additional restraints on exploratory activity.

Illustrative Effects

As for Florida, many of the effects to date have been of the opportunity-threat type, and these were certainly evident in the Socioeconomics Panel's visit to the Bristol Bay area. Attempts to assess these *current* impacts have been limited primarily to the native population, although the effect on the nonnative population was obvious. The question becomes what negative effects might accrue to the native population from their anticipation of the OCS lease sales.

That portion of the native population that still depends on hunting and fishing for subsistence is particularly concerned because of fear that OCS development will harm wildlife habitat. The group tends to view the environment holistically, as a critical element in their survival, rather than as a commodity with a monetary value, and there is a fear that OCS oil development might have subtle but significant impacts on the wildlife environment.

To the Inupiat, for example, the availability of native food is closely related to the quality of life and to their spiritual well-being, as well as their physical health. Because the Inupiat believe that they will have to return to a subsistence livelihood when the era of oil development is over, any prolonged or permanent disruption of their subsistence lifestyle is particularly threatening (TR 85). To the nonnative an oil spill threatens recreation, business, and environmental and economic values, but it seldom is seen to jeopardize the entire culture, history, tradition, and value system.

The native population of St. Lawrence Island has similar fears. They are concerned that air and water pollution will kill significant numbers of marine mammals, avian and fish species, and land and sea plants (TR 89). Even if this did not occur they fear that air, water, noise, and visual pollution could drive wildlife from their traditional habitat or alter annual migration routes. The

Gambell Village natives believe that the development would result, at a minimum, in less to eat. At maximum there would be severe damage, either to their culture or to the health of the people (TR 89). To assure such a community that a major spill might occur only once every 30 or 50 years does not allay their fears; they have been in place for centuries. The potential for long-term harm to the community is too great and the prospect is too frightening for any risk.

Although it is true that a major oil spill might not affect an entire fishery, such as Bristol Bay, it could have a profound effect on a particular village or community. Such an effect, even for a year or two, could substantially alter the community's culture, economics, and lifestyle. Even high-level production, without any spills, could introduce enough new residents to an area to produce deterioration of the highly important patriarchal structure (TR 89).

Disruptions to bearded and spotted, or ringed, seals or disruptions to walrus and any of the whale species could severely threaten the food supply to the Village of Gambell. Moreover, the Gambell natives are fearful that, if this occurs, state and federal agencies could not, or would not, move rapidly enough to prevent famine, especially among the infirm.

The *future* effects of OCS activity on the native population are expected to vary depending on the degree to which the village or community is assimilated into the white culture, and on the degree to which alternative employment opportunities exist. In the the case of the Beaufort Sea leasing, the sale occurred in 1988 and production is expected to begin in 1996. One assumption is that the new pipelines and shore bases would add a maximum of $400 million to borough property values in 1995, with this value depreciating by about 5% annually in subsequent years. Total oil industry employment was estimated to increase by a maximum of 2010 during the peak construction year of 1995; the increase in operating employment would be between 600 and 700 after 1997 (TR 120).

In the Chukchi Sea lease sale, borough property values were estimated to increase a maximum of $1,428 per acre in 1998 and depreciate 5% annually thereafter. Total oil industry employment would increase by up to 4,887 during the peak construction year of 1998, and operating employment would increase by about 2000 jobs after the turn of the century (TR 120). This increase in jobs does not, however, translate into a proportional increase in new employment for the native population, most of whom do not have the needed skills or training. If no sale took place, native employment would be expected to increase modestly from 799 jobs by the year 2000; if the sale does go through, only 151 new jobs (an increase to 900) would be created for natives in the same period (TR 120). A general decline in native population is predicted without the lease sales. The sales would presumably slow this emigration for about 10 years.

It is estimated that without the lease sales, operating revenues for the North Slope Borough will continue to decline. The lease sales would presumably slow this decline. Yet on St. Lawrence Island, which has not been so invaded by nonnative culture to date, the very real possibility for serious disruptions of marine mammal, bird, and sea plant harvests are not balanced by promises of increased taxes, local employment, locally owned business, or governmental subsidies (TR 89). The experiences of North Slope Eskimos make such promises appear empty. Substantial economic gains to rank-and-file Eskimos have simply not accompanied energy developments on or near native islands (TR 89).

If North Aleutian Sale 92 proceeds, the draft environmental impact statement predicts a modest to negligible effect on fisheries and marine mammals, but the statement concedes that in some areas, such as the area west of Port Moller, there could be major damage if a spill occurred.

Pacific Region

Development of California's offshore oil resources is long-standing, dating back to the end of

the nineteenth century. Offshore oil development, however, has invariably been marked by controversy. In south-central and southern California, where there is extensive experience with offshore oil development, the debate has centered on whether and how additional development should proceed. In the central and northern part of the state, where there has been no history of development, debate in recent years has involved mainly the question of whether offshore leasing, the first step toward development, should take place. Because these areas and their situations are essentially different, each is treated separately.

South-Central California

Nature and Extent of Development[2]

Offshore development made its debut in the United States off the coast of Summerland (about five miles south of Santa Barbara) in 1896 when wooden piers and platforms were erected along the shoreline. Offshore oil development was conducted mainly by means of piers close to shore through the 1920s and 1930s. In 1929, the first state leases were issued in the ocean area away from shore, but until the 1950s, offshore oil operations remained confined to the shoreline or to nearshore waters. It was not until the late 1950s that new technology allowed oil companies to extend the range of their exploration. The first truly offshore oil platform, *Hazel*, was built in 1958 in state waters, in 100 feet of water off the shore of Summerland.

With the availability of new technology came new discoveries, and pressure began to mount to explore and exploit California's offshore oil resources as quickly as possible. Fearing that further development of oil fields in the state-controlled area would drain oil pools in ocean areas beyond three miles (those areas were under federal control), the federal government began to lease offshore lands in 1963; other lease sales were held in 1964 and 1966. In a major lease sale in 1968, 71 tracts were leased in the federal zone.

This upsurge in offshore activity was brought to an abrupt halt on Jan. 28, 1969, by the blowout at Union Oil's Platform A in the Santa Barbara Channel. The spill proved to be a catalyst for the rise of the environmental movement of the 1970s, both locally and nationally. Local groups, such as GOO (Get Oil Out), mobilized to impose significant restrictions on oil development. Nationally, coalitions of environmental groups succeeded in getting Congress to enact a wide range of environmental protection laws, about a dozen of them concerned with ocean resources and activities.

The first part of the 1970s thus saw a significant decrease in offshore oil activity in California. In the Santa Barbara area, significant restrictions were placed on offshore leasing and drilling. The state legislature established sanctuaries that put certain areas along the coast off limits to oil and gas development and imposed a moratorium on drilling in existing state leases until 1973. Not until 1983 did the California State Lands Commission consider resuming offshore leasing in the Santa Barbara Channel.

The Arab oil embargoes of 1973 and 1974, however, led to new pressure to develop domestic oil reserves, and in several controversial and heavily litigated lease sales between 1975 and 1983, the federal government leased 217 additional tracks covering about 1.2 million acres off the coast of southern and central California. In 1984, 23 federal tracts were leased off the coast of southern California. Since 1984, Congress has prevented the Department of the Interior from conducting any further OCS lease sales through the imposition of moratoria on department expenditures for these purposes.

[2] This section is adapted from Cicin-Sain (1986).

As of 1989, there were 123 existing leases encompassing 637, 757 acres in the Pacific outer continental shelf. Most of the leases were in the Santa Barbara Channel (67 leases off the shore of Santa Barbara and Ventura counties) and in the Santa Maria Basin (44 leases off the shore of San Luis Obispo and Santa Barbara counties); 12 leases were south of the Santa Barbara Channel (MMS, 1990).

Intensified exploration in federal waters from 1980 to 1985 made it clear that there were large oil reserves in the Santa Barbara Channel and Santa Maria Basin; estimates ranged up to 2.2 billion barrels of oil and 6.2 trillion cubic feet of gas (MMS, 1990). These reserves could represent the largest discovery in the United States since the discovery in 1968 of reserves in Prudhoe Bay, Alaska, and the area could become one of the world's major oil provinces (Williams, 1984).

After these discoveries, several large offshore oil projects (involving large platform complexes as well as related onshore processing facilities and marine terminals) were proposed by lease holders, most prominently Exxon, ARCO, Chevron, and Unocal. Initial projections estimated a peak production of 500,000 barrels a day by 1992, which would require doubling the number of offshore platforms, significant increases in exploratory seismic activity, construction of new pipelines and marine terminals, and a 4,000% increase in the capacity of onshore processing facilities. These initial figures, however, have since been revised downward for several reasons, including declines in the price of oil and extensive delays in the permitting process.

Public Response

Responses to the significant increases in offshore oil development in the 1980s must be understood in the context of the great natural beauty of the Santa Barbara area and the culture of its citizenry. This coastal area of California is a well-known tourist destination. It is a highly attractive natural environment, flanked by the ocean on one side and a coastal mountain range on the other. The ocean is generally visible and accessible from the state's major coastal highway, in contrast to other oil-rich coastal communities, such as those in Louisiana where the shoreline is often difficult to reach, or even to identify exactly, given the presence of extensive wetlands. Because most of the oil deposits in the federal OCS lie near the three-mile federal-state boundary, any offshore development is highly visible from shore. The ocean in the Santa Barbara area, too, is home to many users, including recreationists, commercial fishermen, the military, marine scientists, and shipping companies. The area's citizens are very environmentally aware (partly as a result of the 1969 oil spill) and well organized into several public advocacy groups. Over the years, citizens' groups have pushed for a series of limited-growth policies (including restrictions on water supplies) aimed at conserving the environmental beauty and quality of life of the area.

Thus, when significant new development was proposed in the early 1980s, residents and local governments strongly reacted, first in opposition, and later in efforts to mold the pace and nature of the development. The period from 1983 saw an extensive set of negotiations between local and state authorities, the oil companies, commercial fishermen, and environmental groups over the pace, nature, and magnitude of development. The county of Santa Barbara was instrumental in these negotiations—using its authority over the permitting of onshore resources and, together with the state, over air quality out to three miles offshore—to mold the nature of development in federal waters.

There were several major issues of concern (Cicin-Sain, 1986):

- Industrialization of the region and proliferation of support facilities was opposed by local officials and community groups, who feared that the inevitable large increase in shoreside support facilities and services for offshore oil production would radically alter the quality of life of the area by industrializing the coastline.

- Deterioration of air quality was an issue in this area, which already fell below federal standards. Local authorities were concerned that pollutants released by diesel engines on drillships and support vessels, as well as by processing facilities, could significantly increase the existing air pollution problem. Offshore air pollution is a problem in California that is not present in other oil-producing regions in the country (with the possible exception of the West Coast of Florida). Atmospheric conditions peculiar to coastal California involve a combination of the amount of sunlight, the mixture of pollutants already present, the direction of prevailing winds, and the presence of coastal mountain ranges—all of which work to trap smog along the coastal strip. A major problem here has been that air quality standards for air above federal waters were not as stringent as those for state waters.[3]
- State and local officials called for oil transportation by pipeline rather than by tanker to reduce the risk of oil spills and to decrease pollutant emissions into the air. After a marine emergency management study, the county also called for stringent measures for oil spill prevention and cleanup.
- Concerns were raised about the toxicity of the lubricating fluids used in the drilling processes and their potential to harm marine life. Also at issue were the possible effects of acoustic signals transmitted during the geophysical exploration process on fish eggs and larvae and on fish dispersal.
- Increased vessel traffic and the presence of a variety of marine structures (platforms, drillships, pipelines) can, because of the limited size of the continental shelf, displace such other users of the marine environment as commercial fishermen, recreational boaters, commercial transportation operators, and ocean scientists. It was feared, in particular, that commercial fishermen could lose their traditional fishing grounds and periods, suffer loss or damage of gear, and even experience the loss of their livelihoods.
- Considerable controversy also surrounded the potential for population growth (from the influx of oil workers) in an area where water resources are scarce and population growth controls are in effect. Questions were raised, for example, about the effects on housing, schools, and transportation. Similarly, concerns about the distribution of benefits (who would get the new jobs) were frequently voiced.
- The effect on local governments was given attention because of the expected increased burdens in planning for and regulating the onshore effects of oil development.

With support from the California Coastal Commission, Santa Barbara County exacted several compromises from the oil companies and imposed several permit conditions to ensure that development would be compatible with the preservation of the south-central coast and the many uses of its offshore waters. The negotiations were complex and protracted and involved local, state, and federal bargaining and litigation. The compromises involved permit conditions that were the most stringent the oil industry had seen in the United States. (As an Exxon executive put it, "Santa Barbara permitting is the toughest…. There is an extreme amount of mitigation requirements attached to our permit and to the other operators that are successful in permitting in the county" (Cicin-Sain and Lee, 1990)).

Conditions required the consolidation of onshore processing facilities (to prevent the

[3] However, in 1990 Congress acted in two ways to solve this problem. First, as noted earlier, it increased the authority of the coastal states, through the consistency process, to manage effects that occur outside the coastal zone that affect coastal zone resources (16 U.S.C. 1456(c)). Second, in the 1990 reauthorization of the Clean Air Act, Congress mandated that "to control air pollution from Outer Continental Shelf sources" (excluding the Gulf Coast except Florida) air pollution requirements "shall be the same as would be applicable if the source were located in the corresponding onshore area" (42 U.S.C. 7627(a)(1)).

industrialization of the coast through the proliferation of facilities); oil transportation by pipeline; the creation of several mitigation funds; and the establishment of a detailed program to monitor the socioeconomic effects of offshore oil development and to provide the basis for additional mitigation, if needed.

Illustrative Effects

With the exception of two studies (Centaur Associates, Inc., 1984a,b), offshore oil development prior to the discoveries in the 1980s is not well documented. The reports conclude that neither state nor federal oil and gas activities were a dominant force in the development of Santa Barbara or Ventura counties. The studies excluded such socioeconomic effects as the mobilization of the local community as a result of the 1969 oil spill and the periodic displacement of commercial fishermen as various offshore facilities were erected, used, and later abandoned (Kallman and Wheeler, 1984).

Effects that occur as a result of the discoveries of the early 1980s also are difficult to detail because there are no baseline studies of the population or affected groups (such as commercial fishermen). However, observations during the past decade by several analysts, including one member of the Socioeconomics Panel (Amy, 1983, 1987; Cicin-Sain, 1986; Cicin-Sain and Tiddens, 1989; Cicin-Sain and Lee, 1990), suggest the following: There have been significant effects in terms of the activation of community groups; there has been great growth in the planning capacity of local governments and in intergovernmental experimentation; significant effects have been seen in commercial fishing; and fewer socioeconomic effects (narrowly defined in terms of population growth and related issues) were experienced than had been anticipated.

Increased citizen participation was an important ingredient in the negotiations, and such groups as the Citizens Planning Association and the Sierra Club were instrumental in the outcome. Citizen involvement has been manifested not only in the Santa Barbara area but in other coastal areas of California as well. Concern over offshore oil development statewide led to the adoption of citizen initiatives in 13 coastal cities and counties; all of them require some kind of citizen approval before onshore oil facilities can be constructed (MMS, 1990).

In the early 1980s Santa Barbara County had little involvement or expertise in offshore oil development, but the county government has since greatly built its oil-planning capacity. In addition, the county has displayed considerable ingenuity and aggressiveness and has pioneered such successful intergovernmental coordination as the Joint Review Panel, the vehicle used by representatives from local, state, and federal agencies to prepare the required state and federal environmental impact reports and environmental impact statements (EIR/EIS) (Alarcon et al., 1987; Kahoe, 1987; Hershman et al., 1988).

Another county-initiated innovation has been the institutionalization of four mitigation programs. The first, the Environmental Quality Assurance Program, requires full-time on-site staff from the county to monitor compliance with complex project regulations. The second, the Coastal Resources Enhancement Project, reduces residual or cumulative effects that cannot be mitigated by a project-specific measure. The third, the Socio-Economic Monitoring and Mitigation Program ensures that oil companies pay for public services or infrastructure resulting from new oil and gas development. The fourth, the Local Fishermen's Contingency Fund and the Fisheries Enhancement Fund, provide money to offset fishermen's gear losses and to support projects designed to offset harm to commercial fishermen (Cicin-Sain and Tiddens, 1989).

Effects on commercial fishermen have been extensive, although not well documented. As reported in a survey conducted on behalf of Santa Barbara County (Cicin-Sain and Tiddens, 1989),

fishermen have been kept out of fishing grounds (entailing costs not only for fishermen in the area but also increased competition in other areas and losses to fish processors). Increased vessel traffic has resulted (entailing congestion at sea and increased competition for harbor space). There also have been possible effects on fishery resources, loss or damage to fishing gear, and division of the fishing community (some fishermen are paid for moving gear or for not fishing while others are not). Some of these effects have been mitigated through various local and state funds and through the efforts of a joint oil-and-fishing committee. Mitigation has been partial and the full effects have not been measured (Cicin-Sain and Tiddens, 1989).

Effects on population growth, job distribution, and attendant issues have been reviewed by the Socio-Economic Monitoring Program (SEMP), initiated by the county in 1985 to measure and track expenditures made by the oil industry (including subcontractors) in the area. A computer model developed for SEMP uses expenditure data to predict immigrant population effects generated by each project. The data are combined with baseline data provided by the tri-county governments to estimate each project's effect on public services, public finances, and housing availability. This program is used by local governments to mitigate significant impacts (MMS, 1990). Preliminary findings from SEMP data suggest two major conclusions: The amount of expenditure that seems to be "sticking locally" is insubstantial compared with the overall size of the capital investment in these projects (J. Patton, pers. comm., Resource Management Division, Santa Barbara County, 1989), and the number of new workers who have moved to the area has been smaller than suggested by the worst-case scenarios in the environmental impact reports (M. Powers, pers. comm., Tri-County Socio-Economic Monitoring Program, 1989). This is partly a result of the phased nature of the development that Santa Barbara's citizens and government were able to require—precisely to avoid falling prey to the boom and bust cycle.

The Santa Barbara case is an interesting example of the coexistence of an attractive community and offshore oil development. The keys to this coexistence appear to be the phased nature of the development, the extensive permitting required for each project (numbering in the hundreds for each), the various mitigation measures that have been put into effect, socioeconomic monitoring, the presence of an ever-watchful local citizenry and an able local government, and the general willingness of the oil industry to remain at the negotiating table.

The Santa Barbara story, however, is far from over: Construction is just beginning on some of the projects. Future challenges center primarily on the monitoring and enforcement of conditions that have been agreed to, and the pressures that will arise as proposals to develop other parts of the Santa Barbara Channel and Santa Maria Basin are put forward.

Central and Northern California

Nature and Extent of Development

In contrast to the situation along the south-central coast of California, where the controversies revolved around *how* oil should be developed, the issues in northern California centered on *whether* proposed leasing should be allowed at all. Both of the lease sales proposed for these two areas—Sale 119 for central California and Sale 91 for northern California—have been thwarted by a coalition of environmental groups, tourism interests, coastal governments, commercial fishermen, and coastal residents who have mobilized to block the development.

Sale 91, first proposed in 1986 and scheduled for February 1989, has been put on hold, first through a series of congressional moratoria and more recently by President Bush, following the advice of his OCS task force (OCS Leasing and Development Task Force, 1990), until the year 2000

(Bush, 1990). The lease area contains approximately 1.1 million acres and is estimated to contain between 20 million and 820 million barrels of oil and about 1.0 trillion cubic feet of natural gas (Bush, 1990).

Sale 119, announced in 1988 and scheduled for March 1991, has similarly been put on hold through congressional moratoria and the presidential action, until the year 2000. Moreover, the president directed the secretary of the interior and the National Oceanic and Atmospheric Administration administrator to adopt the Monterey Bay National Marine Sanctuary proposed by NOAA, permanently prohibiting oil and gas exploration and development within the sanctuary (Bush, 1990).

Public Response

Because reactions to proposed development in central and northern California were largely similar, we concentrate here on the responses in northern California, which the Socioeconomics Panel visited in July 1989.

Public reaction to proposed offshore oil development must be viewed in the context of the northern California coast—a beautiful, rugged, and sparsely populated coastline. Many of its residents have moved to the area precisely because of its beauty, ruggedness, and isolation. The region is truly a spectacular coastal area. It has an abundance of marine mammals, birds, and fish, and its magnificent redwoods run to the sea's edge. Dominant industries include timber (which has declined in recent years), commercial fishing, and tourism.

Reactions to the proposed development off the shore of northern California have been almost consistently negative and highly emotionally charged. Since the time leasing was first proposed in 1986, public groups in the small coastal communities have coalesced into an anti-oil movement, lobbying local, state, and federal officials to prevent the sale from taking place. Citizen participation reached a peak in February 1988 when several thousand residents jammed a public hearing in Fort Bragg on Sale 91. As a long-time student of OCS development and public reaction to high-level radioactive waste disposal, sociologist William Freudenburg reported he was dazed by what he saw in the tiny northern California coastal town (W. Freudenburg, pers. comm., University of Wisconsin, 1989). Freudenburg reported he had never seen such intensity on the part of citizens at a public hearing. One sign spoke for the community, "Save the Kansas Coast." Residents believe that the northern California coast is a national treasure; it is the coast of the citizens of Kansas, too.

Citizen concerns focused on the following issues. Perhaps first and foremost was their unwillingness to take any risks with the special northern California environment for the sake of supplying oil to the nation for "only 28 to 45 days" (the estimated available resource offshore). This theme was emphasized again and again in various public fora ("there is no such thing as 'reasonable' degradation to the marine environment"). In particular, opposition to offshore oil development was tied to the absence of a national energy policy: "Why risk an area that depends on its natural resources for its social and economic health for a very small amount of oil when the federal government is doing nothing about energy conservation?" Other major concerns were with economic losses to tourism, recreation, and the fishing and timber industries. Fears of a boom and bust cycle were expressed for an area already unstable because of the decline in the timber industry. Threats to the marine environment and the fishing industry were repeatedly echoed at public hearings. It is interesting to note, that, with very few exceptions and in contrast to other regions, the question of obtaining potential benefits from offshore oil development was not a factor.

Illustrative Effects

The effects experienced in this case are primarily the same as the opportunity-threat impacts evident in Florida and Alaska, which the Socioeconomics Panel has noted earlier (NRC, 1989). However, in northern California these are perhaps clearer than they are in any other OCS region. The intensity and breadth of protest, community organization, and commitment in opposition to OCS activities leaves little doubt that significant social impacts have occurred, despite the fact that no lease sale has taken place.

Oregon and Washington[4]

Nature and Extent of Development

Several sedimentary basins are located on Oregon's and Washington's outer continental shelf that could contain commercially recoverable quantities of oil and gas. Federal lease sales were held in 1964 (MMS, 1989), and although several exploratory wells located petroleum-bearing strata, none registered commercial quantities. There are no active leases today in state or federal waters.

In 1985 MMS conducted additional exploratory sampling off the coast of Oregon and Washington (Cook, 1985). Results from that study, although highly speculative, are the most often-quoted offshore oil and gas deposit estimates for development in the region. According to MMS, 180 million to 300 million barrels could lie off the Oregon and Washington coasts, of which 50 million to 60 million barrels might be recoverable at 1987 prices. This amount represents roughly enough oil to fuel the nation for three days (Good et al., 1987). Natural gas estimates of 3.26 trillion cubic feet were much more promising. The annual national demand is approximately 16 trillion cubic feet.

Public Response

With those potential resource estimates in hand, the Department of the Interior's Sale 132 was set to take place in April 1992. The planning area encompassed 190,900 square miles (12.7 million acres) off the Oregon and Washington coasts. The sale was strongly opposed by Oregon Governor Goldschmidt and Washington Governor Gardner, who requested the secretary of the interior to postpone "Minerals Management Service's ill-conceived proposal to open the entire outer continental shelf off the Oregon/Washington coasts to oil and gas leasing and development" (Governors' Letters, 1989).

Illustrative Effects

As with northern California, the existing effects have been limited to opportunity-threat impacts, and these appear to be less than those in northern California. Strictly considering the potential resource itself, it appears unlikely that substantial oil and gas development would occur off the coast of Oregon or Washington in the next 15 years. The estimates of the resource are low, and the costs of exploration and development stand as significant obstacles to any substantial oil and gas

[4] This section is adapted from Cicin-Sain et al. (1990).

production near the two states. Three factors, in particular, contribute to these high expenses. First, the area's severe weather, especially during the winter, would hamper operations and endanger workers and equipment. Second, unless the oil is located within the shallow state waters, costs would increase rapidly because the water is much deeper off Oregon and Washington than it is elsewhere. Third, both states lack oil pipeline networks common in the Gulf of Mexico. Because resource estimates are so small, the construction of a pipeline is unlikely. Consequently, oil transportation would likely be by tanker—a much more expensive method than pipeline (Good et al., 1987).

In his June 26, 1990, policy statement on offshore oil development, President Bush accepted the recommendations of the Outer Continental Shelf Leasing and Development Task Force (1990). The president's decision affecting Oregon and Washington was to conduct a series of additional environmental studies of the effects of oil and gas development off Washington and Oregon, including the Sale 132 area, before any environmental impact statement would be completed. These studies are expected to take 5 to 7 years, but have not begun. No sale will be considered until after the year 2000 and then only if studies show that development can be pursued in an environmentally safe manner (Bush, 1990).

Atlantic Region

Nature and Extent of Development

Five geological formations in federal waters along the Atlantic continental shelf have been identified as potential sources of oil and gas recovery: the Georges Bank Basin off Cape Cod, Massachusetts; the Baltimore Canyon Basin off Atlantic City, New Jersey; the Carolina Basin off Cape Hatteras, North Carolina; the Southeast Georgia Embayment; and the Blake Plateau Basin off Florida's east coast (Weise, 1986). To date, however, there has been little OCS exploration and no production.

There are three planning areas in the Atlantic OCS region: north, mid-Atlantic, and south. To these the Straits of Florida was added in 1986. Since OCS leasing began in 1976, activity in the region has centered on Georges Bank in the north Atlantic; Baltimore Canyon and, more recently, the Carolina Basin in the mid-Atlantic; and the Southeast Georgia Embayment in the south Atlantic.

Leasing activity in the Atlantic OCS region began shortly after the oil embargo in 1973. The first—and still most profitable in the history of the region—was Sale 40 (Baltimore Canyon) in 1976. Summarizing the first 10 years, Wiese (1986) reports that

> [nine] lease sales have been conducted by MMS, 410 leases have been issued to the offshore industry, and 46 exploratory wells have been drilled. To date, these efforts have not produced a commercially recoverable discovery of oil or gas. This drilling history together with the current declining market for oil and gas has reduced OCS related activities in the Atlantic OCS region…. There are no announced plans for additional drilling on the Atlantic OCS by offshore operators.

One exception is the exploration plan submitted by Mobil Oil Company recently for the Manteo Exploration Unit off of Cape Hatteras. Otherwise the picture has not changed materially since 1986. The leasing history of the region is given in a list of scheduled sales and their current status (Table C-2).

TABLE C-2 Leasing History of the Atlantic OCS Region Through 1991

Sale	Year*	Location	Status
49	1976	Mid-Atlantic	Lapsed
43	1978	South Atlantic	Lapsed
42	1979	North Atlantic	Lapsed
49	1979	Mid-Atlantic	Lapsed
54		South Atlantic	Canceled
56	1981	Mid-Atlantic (Carolina Basin)	Active
59	1981	Mid-Atlantic	Inactive
RS-2	1982	South & Mid-Atlantic (reoffering)	Inactive
52	1983	North Atlantic	Canceled
76	1983	Mid-Atlantic	Inactive
78	1983	Mid-Atlantic (Carolina Basin)	1-year moratorium (1990-91)
82	1985	North Atlantic	Canceled
90	1986	South Atlantic	Canceled
108	1990	South Atlantic	Deferred
111	1986	Mid-Atlantic	Canceled
96	1988	North Atlantic (Georges Bank)	Canceled; 10-year moratorium (to ~2000)
121	1989	Mid-Atlantic	Deferred
108	1990	South Atlantic	Deferred
134	1991	Mid-Atlantic	Pending

* Year of sale
Totals for the Atlantic OCS Region through 1986: North Atlantic: 1 sale, 2 COST and 8 exploratory wells, no commercial discoveries; South Atlantic: 4 sales, 1 COST and 6 exploratory wells drilled, no commercial discoveries
Source: Adapted from Weise, 1986; MMS, 1988.

Public Response

After the oil embargo in the fall of 1973, President Nixon directed the secretary of the interior to increase the OCS acreage leased to 10 million acres beginning in 1975—an amount equal to all the acreage leased since the program began in 1953. "The basic objective of the proposed action in OCS development was to increase domestic production as rapidly as possible and reduce dependence on expensive and unstable foreign supplies" (Committee on Commerce, 1975). Of the 16 "frontier" states affected, 14 were on the Atlantic coast.

A report by the U.S. Department of Commerce (1978) noted that although the states would support orderly development, the Department of Interior's "lack of awareness of the issues and concerns at the state level" might retard instead of accelerate OCS development. Indeed, "Following the decision to accelerate leasing, numerous bills that would amend the OCS Lands Act were introduced in the 94th Congress. None [was] enacted. Largely because of strong State objections and DOI's efforts to provide more meaningful public and State involvement, the OCS leasing

timetable has been slowed down since 1975" (U.S. Department of Commerce, 1978). During the Reagan administration, the shift to areawide leasing and streamlined procedures introduced by Secretary Watt evoked similar public and community responses.

In the 1980s, Sales 82 and 96 (Georges Bank) became focal points of OCS controversy. Sale 96 was scheduled for 1988, despite the fact that since 1982 congressional moratoria attached to the annual appropriations bill for the Department of the Interior had prohibited drilling on Georges Bank. Massachusetts also requested the exclusion of Georges Bank from Sale 96 (MMS, 1986). The Canadian government had already instituted a 12-year moratorium affecting its sector of Georges Bank, more for political than for environmental reasons. (Exploratory drilling was permitted by the Canadian government in the similarly productive Grand Banks area—the Hibernia Development Project.) Sale 96 was finally canceled by presidential decree on June 26, 1990. In his statement, President Bush declared that he was canceling Sale 96

> and directing that no leasing and development take place in this area until after the year 2000. This will allow time for additional studies to determine the resource potential of the area and address the environmental and scientific concerns which have been raised (Bush, 1990).

At the request of North Carolina, drilling in Manteo Exploratory Unit also was placed under a one-year moratorium in recent congressional action to permit further environmental studies.

Illustrative Effects

It does not follow from the lack of OCS development that there has been a lack of impacts. Chief among these have been the opportunity-threat impacts linked to scheduled lease sales and, in turn, to public and community response. The public response took place against a background of controversies over the siting of oil ports, terminals, and refineries for landing and processing imported oil (Carter, 1978; University of New Hampshire, 1974).

Although public and community response must count heavily in assessing the socioeconomic impacts of Atlantic OCS region activities, there have been few socioeconomic studies undertaken by MMS or its predecessor, the Bureau of Land Management. A critical review of the adequacy of environmental information for Sale 96 was recently issued by the National Research Council's Committee to Review the Outer Continental Shelf Environmental Studies Program (NRC, 1990). There have been state- and county-sponsored studies prompted by the anticipated impacts, however, funded under the (former) Coastal Energy Impact Program (Section 308 of the Coastal Zone Management Act Amendments of 1976) and other legislative authorization, particularly the Sea Grant Program.

Community impacts were experienced in the early stages of mid-Atlantic exploration in the case of the Brown and Root proposal for siting a 2,000-employee platform fabrication plant in the rural community of Cape Charles, Virginia (Urban Pathfinders, 1975a,b). There also have been effects on institutional arrangements for increasing local and regional planning capability in regard to managing OCS development. One example is the formation of the Mid-Atlantic Governors Association (Wilson, 1982). A related category of institutional impacts is that of intergovernmental relations, especially in the consistency provisions of the Coastal Zone Management Act (Section 307(c)(1)).

In large part, the story of the Atlantic region has been one of inflated resource estimates and disappointing finds. In his statement, President Bush called for additional studies of Georges Bank

"to determine the resource potential of the area and address the environmental and scientific concerns which have been raised." The crisis in the Persian Gulf revived concerns about disruptions of the oil supply and renewed interest in onshore and offshore production of domestic oil and gas. Widespread concern over global warming has promoted natural gas as a fuel of choice; and gas is more likely than oil to be found on the Atlantic OCS (Kerr, 1979).

The story of the Atlantic region is also one of failure to adapt or create institutional arrangements for forging a consensus among interested parties. President Bush continued his statement of June 26, 1990, "My goal is to create a much more carefully targeted OCS program—one that is responsive to local concerns, to environmental concerns, *and* to the need to develop prudently our nation's domestic energy resources" (emphasis in the original). He concluded, "My desire is to achieve a *balance* between the need to provide energy for the American people and the need to protect unique and sensitive coastal and marine environments" (emphasis in the original). The lesson learned in the Atlantic region underscores both the difficulty and the necessity of achieving that balance.

SUMMARY AND CONCLUSIONS

Although the contrasting perceptions of the risks and benefits of OCS development arise from differing historical, physical, and social circumstances in the geographical and cultural areas where they are born and nurtured, through the political process these competing perspectives spread and become the anchor points for a national debate over OCS development. Since the OCS leasing program was developed in the Gulf of Mexico, in an ironic twist, the unique perspective that had evolved in the Gulf became more or less the perspective of the federal agencies initially charged with the OCS program (U.S. Geological Survery and Bureau of Land Management), and resulted in increasing conflict between these federal agencies and the majority of the coastal states.

Today for all practical purposes the outer continental shelf of most of the continental United States is closed to development, and MMS—the agency whose primary goal is "orderly development of the marine mineral resources" (MMS, 1987)—finds its position in conflict with that of most of the coastal states. This has resulted in MMS being denied access to the majority of those resources.

The Gulf "model" simply has not worked outside the socioeconomic and political environment where it emerged, and it is instructive to note that the only other successful OCS development has occurred under an almost diametrically opposite model in the southern California area. It is interesting that this development, unlike that in the Gulf, clearly follows the requirements of OCSLA to monitor the effects of OCS activities subsequent to leasing. The implications of this fact are not lost on the Socioeconomics Panel.

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Appendix D

SOCIAL AND ECONOMIC STUDIES TECHNICAL REPORTS ALASKA OCS REGION, MMS

(Provided by the Alaska OCS Region, Minerals Management Service. The panel reviewed only documents that were available by mid-1991.)

Report No.	Title	Published
SR-1	Statewide Impacts of OCS Petroleum Facilities Development in Alaska. University of Alaska Anchorage, Institute of Social and Economic Research (ISER). (A06/PB 80-108707)	7/79
SR-2	Northern Shelikof Strait Petroleum Facilities Siting Study. Dames and Moore.	2/80
SR-3	The Marketing and Equivalent Amortized Costs of Bering-Norton Oil and Gas. Dames and Moore.	6/80
SR-4	Small Community Population Impact Model. ISER.	6/80
SR-5	Review of Cumulative Impact Assessment Literature and North Slope Borough Development Projects. Maynard and Partch (A21/PB 87-190286/AS) (MMS 85-0014)	2/85
SR-6	Proceedings of a Workshop: Review of Outer Continental Shelf Economic and Demographic Impact Modeling for Rural Alaska. Lawrence Johnson and Associates. (A07/PB 87-204699/AS) (MMS 85-0080)	3/85
SR-7	Regional and Village Corporation Employment Profiles. Kevin Waring Associates. (A04/PB 90-164419/AS) (MMS 89-0084)	9/89
SR-8	Subsistence Resource Harvest Patterns: Nuiqsut. Impact Assessment, Inc. (MMS 90-0038)	7/90
SR-9	Subsistence Resource Harvest Patterns: Kaktovik. Impact Assessment, Inc. (MMS 90-0039)	7/90

TR-1	Definition of Alaska Petroleum Development Regions. PMM, URSA, CCC/HOK, and Dames and Moore. (A05/PB 291915/AS)	8/78
TR-2	Literature Survey, PMM, URSA, CCC/HOK, and Dames and Moore. (A21/PB 269244/AS)	4/77
TR-3	Beaufort Sea Basin Petroleum Development Scenarios for the Federal Outer Continental Shelf: Interim Report. PMM. URSA, CCC/HOK, and Dames and Moore.	12/77
TR-4	Prudhoe Bay Case Study, CCC/HOK, Inc. (A06/PB 281544/AS)	2/78
TR-5	Beaufort Sea Baseline Studies: Interim Report. CCC/HOK, Inc.	12/77
TR-6	Beaufort Sea Region Petroleum Development Scenarios. Dames and Moore. (A22/PB 283236/AS)	4/78
TR-7	Case Study of Copper Center, Alaska. Holly Reckord (A11/PB 296961/AS)	1/79
TR-8	Beaufort Sea Region Man-Made Environment. Alaska Consultants, Inc. (A13/PB 281634/AS)	4/78
TR-9	Beaufort Sea Region Sociocultural Systems. Worl Associates. (A13/PB 281634/AS)	6/78
TR-10	Beaufort Sea Regional Natural Physical Environment. Dames and Moore. (A03/PB 284567/AS)	5/78
TR-11	Beaufort Sea Region Socioeconomic Baseline. Peat, Marwick, Mitchell and Co. (A18/PB 294339/AS)	7/78
TR-12	Anchorage Socioeconomic and Physical Baseline. Richard L. Ender. (A13/PB 285468/AS)	6/78
TR-13	Anchorage Impacts of the Beaufort Sea Petroleum Development Scenario. Richard L. Ender (A11/PB 291916)	8/78
TR-14	Alyeska-Fairbanks Case Study. Wordsmiths. (A04/PB 284570/AS)	5/78
TR-15	Historic Indicators of Alaska Native Culture Change. Cultural Dynamics, Ltd. (A08/PB 294180/AS)	8/78
TR-16	Governance in the Beaufort Sea Petroleum Development Region. ISER. (A12/PB 294316/AS)	8/78
TR-17	Monitoring Petroleum Activities in the Gulf of Alaska. Dames and Moore. (A05/PB 285408/AS)	8/78
TR-18	Economic and Demographic Impacts of the Beaufort Sea Petroleum Development Scenarios. ISER. (A13/PB 285409)	6/78

TR-19	Man-Made Environmental Impacts of the Beaufort Sea Petroleum Development Scenarios. Alaska Consultants, Inc. (A10/PB 294314)	8/78
TR-20	Transportation Impact of the Beaufort Sea Petroleum Development Scenarios. Dennis Dooley and Associates. (A08/PB 291917)	8/78
TR-21	Natural Physical Environmental Impact of the Beaufort Sea Petroleum Development Scenarios. Dames and Moore. (A06/PB 224571)	6/78
TR-22	Sociocultural Systems Impacts of the Beaufort Sea Petroleum Development Scenarios. Worl Associates. (A06/PB291919)	4/78
TR-23	Summary of Socioeconomic Impacts of the Beaufort Sea Petroleum Development Scenarios. James Lindsay and Associates. (A06/PB294315)	12/78
TR-24	Design of a Population Distribution Model. Lee Huskey, William Serow, and Ted Volin. (A07/PB 299658/AS)	8/79
TR-25	Second Program Summary Report. Peat, Marwick, Mitchell and Co. (A05/PB80-159825)	11/79
TR-26	Developing Predictive Indicators of Community and Population Change. ISER. (A22/PB 80-111628)	4/79
TR-27	OCS Visual Resources Management Methodology Study. Harmon, O'Donnell and Henninger Associates, Inc. (A06/PB 294835)	3/79
TR-28	Socioeconomic Impacts of Selected Foreign OCS Developments. Habitat North, Inc. (A14/PB 297114/AS)	4/79
TR-29	Northern Gulf of Alaska Petroleum Development Scenarios. Dames and Moore. (A18/PB 294229/AS)	2/79
TR-30	Northern and Western Gulf of Alaska—Commercial Fishing Industry Impacts. Alaska Sea Grant Program, Oregon State University, Frank Orth and Associates. (A23/PB 166697)	2/80
TR-31	Northern Gulf of Alaska—Transportation Systems Impacts. Peter Eakland and Associates. (A17/PB 80-212467)	4/80
TR-32	Northern and Western Gulf of Alaska—Local Socioeconomic Baseline. Alaska Consultants, Inc. (A23/PB 296971/AS)	5/79
TR-33	Northern Gulf of Alaska—Local Socioeconomic Impacts. Alaska Consultants, Inc. (A19/PB 80-154487)	10/79
TR-34	Northern Gulf of Alaska—Economic and Demographic Impacts. ISER. (A16/PB 297722/AS)	7/79
TR-35	Western Gulf of Alaska Petroleum Development Scenarios. Dames and Moore. (A17/PB 294281/AS)	2/79

TR-36	Northern Gulf of Alaska—Sociocultural Impacts. Marsha Bennett, Susan Heasley, Susan Huey. (A14/PB 300699/AS)	8/79
TR-37	Western Gulf of Alaska—Transportation Systems Impacts. Peter Eakland and Associates. (A14/PB 80-166630)	1/80
TR-38	Western Gulf of Alaska—Economic and Demographic Impacts. ISER. (A17/PB 300697/AS)	8/79
TR-39	Western Gulf of Alaska—Kodiak Non-Native Sociocultural Impacts. James T. Payne and Associates. (A10/PB80-166648)	1/80
TR-40	Western Gulf of Alaska—Local Socioeconomic Impacts. Alaska Consultants, Inc. (A13/PB 80-108855)	9/79
TR-41	Western Gulf of Alaska—Kodiak Native Sociocultural Impacts. Cultural Dynamics Ltd. (A13/PB 80-158124)	10/79
TR-42	Lower Cook Inlet—Economic and Demographic Analysis. ISER. (A12/PB 80-166705)	2/80
TR-43	Lower Cook Inlet and Shelikof Strait Petroleum Development Scenarios. Dames and Moore. (A12/PB 300701/AS)	7/79
TR-44	Lower Cook Inlet—Commercial Fishing Industry Analysis. Alaska Sea Grant Program. (A23/PB 80-212475)	7/80
TR-45	Lower Cook Inlet Transportation Systems Analysis. Peter Eakland and Associates. (A16/PB 80-210271)	3/80
TR-46 Vol. I	Lower Cook Inlet Local Socioeconomic Systems Impact Analysis, Alaska Consultants, Inc. (A15/PB 80-210289)	3/80
TR-46 Vol. II	Lower Cook Inlet Local Socioeconomic Systems Impact Analysis, Alaska Consultants, Inc. (A20/PB 80-210297)	3/80
TR-47	Lower Cook Inlet Sociocultural Systems Analysis, Stephen R. Braund and Associates. (A19/PB 80-166655)	1/80
TR-48 Vol. I	Gulf of Alaska and Lower Cook Inlet—Anchorage Socioeconomic and Physical Baseline. Policy Analysts, Ltd. (A17/PB 80-166663)	1/80
TR-48 Vol. II	Gulf of Alaska and Lower Cook Inlet—Anchorage Impact Analysis. Policy Analysts, Ltd. (A12/PB 80-166671)	1/80
TR-49	Bering-Norton Petroleum Development Scenarios. Dames and Moore. (A21/PB 80-166689)	1/80
TR-50	Bering-Norton Economic and Demographic Analysis. ISER. (A09/PB 80-222482)	6/80

TR-51	Western Alaska and Bering-Norton Commercial Fishing Industry Analysis. Alaska Sea Grant Program.	8/80
TR-52	Bering-Norton Transportation Systems Analysis. James Lindsay and Associates. (A14/PB 81-179046)	3/80
TR-53	Bering-Norton Socioeconomic Systems Analysis. Policy Analysts, Ltd. (A99/PB 80-212624)	6/80
TR-54 Vol. I	Bering-Norton Sociocultural Systems Analysis. Linda J. Ellanna. (A20/PB 80-219264)	4/80
TR-54 Vol. II	Bering-Norton Sociocultural Systems Analysis. Linda J. Ellanna. (A20/PB 179004)	8/80
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