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NATURAL RESOURCE PROTECTION AND PETROLEUM DEVELOPMENT IN ALASKA

A Summary

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INTRODUCTION

Environmental regulation of development projects has evolved rapidly in recent years from a relatively simple rule-making and enforcement procedure to an extensive and complex process. New surveillance programs are largely a response to the increasing scale and urgency of development activity, especially in energy, and to dramatic expansion of environmental protection concerns.

Environmental surveillance now typically includes a broad array of public and private agencies and interests, the use of multidisciplinary approaches, and, frequently, increased tension between development and environmental values. These characteristics of the surveillance process, in turn, have required innovations in policy, organization, and procedures, and new forms of intergovernmental and interagency coordination; and state-of-the-art environmental surveillance has been advanced as government agencies have responded and adapted to these new requirements.

The continuing task of public resource managers is to build upon the advances that have been made in surveillance programs that effectively balance development and environmental values. This is a difficult task because surveillance systems -- including organization, policies, and stipulations -- must be designed and applied to meet specific field conditions. This is often accomplished in the face of uncertainties about the incidence and nature of impacts, gaps in information, and conflicting perceptions and interests of participants in the surveillance process.

Fish and wildlife managers must, therefore, make maximum use of existing tools and experience to fashion improved methods of fish and wildlife protection in the future. Planning for future projects requires evaluating past development surveillance experience, anticipating future development activities and impact problems, assessing existing management methods and tools, and then designing improved strategies and techniques for the protection of fish and wildlife resources. The present study is intended to further this planning process.

More specifically, the purposes of this multifaceted investigation are --

1. To provide natural resource managers with a framework for understanding the roles and responsibilities of decisionmakers in Federal and State agencies and the chronological sequence of decisions involved in leasing and developing petroleum resources in Alaska, and

2. To provide guidelines for decisionmakers to develop standards of operations for minimizing impacts of petroleum development on fish and wildlife resources and their habitats.

This technical report is divided into seven chapters. Chapter 1 reviews administrative roles, authorities, procedures, and decisionmaking processes for oil and gas leasing and post-lease environmental management. These topics are discussed for both the State and Federal governments.

Chapter 2 provides an overview of past and present oil exploration and development efforts in Alaska, and a general assessment of the most promising areas for future exploration. The major refuges and game ranges are ranked according to their oil potential.

Chapter 3 has two components. The first is a description of the important industry practices associated with each phase of petroleum development; the second is an identification of the physical impacts of these practices and their potential effects on fish, wildlife, and habitat.

Chapter 4 is composed of two case studies of petroleum development and environmental management in Alaska: the Kenai National Moose Range in southcentral Alaska and the National Petroleum Reserve in northern Alaska. Parallels and contrasts are drawn between the two cases, and the effectiveness of protection measures is evaluated in each case to the extent that limited data permit.

Chapter 5 presents our recommendations for strengthening protection of fish and wildlife in government surveillance of petroleum development projects.

Chapter 6 discusses stipulations that have been applied for protection of fish and wildlife during past petroleum development in Alaska, and presents a set of stipulations, drawn from various sources, that Fish and Wildlife personnel can use in monitoring future petroleum development in Alaska.

Finally, Chapter 7 looks at kinds of information needed for effective protection of fish and wildlife during oil and gas development.

CHAPTER 1

AGENCY ROLES AND AUTHORITIES IN FISH AND WILDLIFE PROTECTION

The principal objectives of this chapter are to (1) describe the legal framework and administrative procedures for petroleum leasing and environmental monitoring on Federal and State lands in Alaska and (2) identify opportunities available to fish and wildlife agencies to participate in and influence the management process. While the focus is on fish and wildlife protection elements, we assess these as parts of complex and extensive networks of agencies, authorities, and decisions at both Federal and State levels. Specifically, we want to show how fish and wildlife agencies are (or can be) involved, and at what points this involvement can occur, in both pre- and post-lease phases of petroleum activities on Federal and State lands in Alaska.

In undertaking this review, we took the existing body of laws, regulations, and procedures as given, and reconstructed the management and decisionmaking process first as it might be expected to operate under some typical or normal set of conditions. We also did some preliminary surveys of selected cases of petroleum management in Alaska to indicate how standard sets of rules and procedures have been adapted and applied in particular instances.

Discussion of State and Federal procedures for onshore oil and gas leasing in Alaska has, by necessity, an element of abstraction and supposition to it because so little onshore leasing has occurred in recent years. There have not been any onshore Federal leases issued in Alaska since 1966. Very little State acreage has been leased since the 1969 bonanza sale that brought some $900 million in bonus bids to the state. What little leasing that has occurred on State land has, for various reasons, not resulted in a set of well-developed, explicit procedures. At the present time at the State level, important pre-lease procedures that provide opportunity for protection of fish and wildlife values are new, unused, or unproven; and formal environmental impact assessment is a matter of executive discretion rather than law.

As far as Federal procedures are concerned, however, the absence of significant onshore leasing in Alaska since the mid-1960s does not prohibit a

discussion of Federal roles[1]. This is because modern Federal leasing procedures and management techniques have developed through activity on mineral lands elsewhere in the United States (including geothermal, coal, and petroleum), through leasing of the Outer Continental Shelf (OCS) in Alaska and elsewhere, and through what we have referred to as "special cases" in Alaska such as Trans-Alaska Pipeline System (TAPS), OCS, and the proposed Alaska Natural Gas Transportation System (ANGTS). We believe that these cases probably represent the norm in Alaska and that future Federal onshore petroleum leasing will follow procedures characteristic of them. Thus, although we cannot say precisely what institutional arrangements might be established to administer the procedures in future leasing programs in Alaska (a secretarial order could easily create special ad hoc mechanisms and interagency bodies to manage a particular lease sale), we are quite certain that we have identified the main procedural elements likely to be followed in any future Federal leasing in Alaska.

Each phase of petroleum activity presents an opportunity for the U.S. Fish and Wildlife Service (FWS) to recommend measures to protect fish, wildlife, and habitat. The specific opportunities for intervention may take different forms. In cases involving federal land under the management of BLM, the Fish and Wildlife Service has an advisory role to BLM and other federal agencies that issue permits or authorizations for activities that could result in disturbance to fish, wildlife, or habitat. The Fish and Wildlife Service may make field inspections with the surface managing agency prior to, during, and after operations; it may review written plans or permit applications; it may comment on the adequacy of environmental reviews. In the post-lease period, a formal environmental assessment is required prior to approval of plans of operation and prior to issuance of each permit or authorization. (This assessment could theoretically lead to a full-scale environmental impact statement, but it is unlikely to do so except perhaps in the case of a major development project.) The Endangered Species Act, the Migratory Bird Treaty Act, and other laws also give FWS opportunities to intervene in the pre-lease and post-lease environmental management process.

In Federal land managed by FWS, the essential steps in the process are the same; but FWS has greater opportunity to influence the process by virtue of being the lead agency (e.g., it prepares the EIS, writes the stipulations, issues land-use and right-of-way permits). FWS authority to regulate activities on its own land is limited only by the secretarial or congressional action that opened the land to leasing.

Under the Federal Fish and Wildlife Coordination Act, the State Department of Fish and Game can participate formally in an advisory capacity in Federal leasing procedures. However, there is no State equivalent of this Act (the States are traditionally possessive of their prerogative

(1) Since this report was prepared, Federal onshore oil and gas leasing in Alaska has recommenced following passage of the Alaska National Interest Lands Conservation Act of 1980 (ANILCA) with preparations for leasing of up to 5 million acres on the National Petroleum Reserve - Alaska (NPRA) by late 1982. Leasing plans for other Federal lands in the state are to be announced in late 1981.

in the management of fish and wildlife resources) that allows FWS to intervene routinely as an advisor in State leasing procedures. While recommendations from FWS might be sought by the Department of Fish and Game formally or informally on an issue of mutual concern, the Federal agency would normally be involved in petroleum-related activity on State lands only if a Federal permit is required.

It is impossible to generalize about the length of time pre-lease procedures require. There seems to be no typical schedule because so many variables are involved. The process may take from several years (as in the case of Federal OCS lease sales) to only a matter of months (as in the case of the recent State sale of leases in the Copper River Basin). These variables include such factors as the amount of acreage involved, the severity of the climate and terrain, geologic and other natural hazards, environmental sensitivity, resource-use conflicts, and public interest. While statutes and regulations may specify minimum periods of time for interagency review and comment, prior public notice, and hearings, these do not collectively establish a timetable for pre-leasing events.

The national environmental awareness that developed in the late 1960's has profoundly affected petroleum leasing procedures on both State and Federal lands. Environmental reviews and protective measures have been woven into petroleum leasing and management processes. This is true at both the State and Federal levels, although Federal procedures are currently more rigorous, formal, and well-developed than the State procedures. These environmental reviews have expanded the scope and frequency of interagency cooperation, and they have doubtless improved the effectiveness of cooperation. Environmental reviews have certainly increased the public accountability of administrative action. The requirement for these reviews has resulted in much lengthier and much more comprehensive pre-lease procedures and generally more systematic and formal decisionmaking processes. Consequently, the opportunities for fish and wildlife managers to influence pre-lease and post-lease decisionmaking have increased enormously in the past decade.

CHAPTER 2

PETROLEUM DEVELOPMENT IN ALASKA: PAST AND FUTURE

INTRODUCTION

The purpose of this chapter is to discuss the history of oil and gas development in Alaska and provide a perspective on future onshore petroleum development in Alaska. Discussed are lease sales, exploration activities, development, production, transportation and termination of oil fields in Alaska. This review of petroleum activity in Alaska focuses on upland developments, but included are those offshore activities inter-related with onshore development (e.g., infrastructure sharing arrangements). For example, a discussion of the Cook Inlet development is not meaningful without describing the closely-linked onshore and offshore developments. Description of the North Slope exploration, as a second example, is not complete without a discussion of offshore exploration in the Beaufort Sea.

An additional purpose of this chapter is to speculate about future onshore petroleum development, identifying the potential for and possible chronological sequence of the development of Alaska petroleum resources. This speculation is made to indicate the possible location and extent of exploration and development on lands that are or may be under the administration of the U.S. Fish and Wildlife Service.

HISTORY OF PETROLEUM DEVELOPMENT IN ALASKA

Overview

Table 1 summarizes the history of petroleum development in Alaska.

Before the discovery of the Prudhoe Bay field in 1968, the history of oil and gas exploration had passed through three phases which can be summarized as follows:

1. The first exploration phase occurred around the turn of the century (1898-1910) and involved shallow exploratory drilling in three locations -- Controller Bay on the Gulf of Alaska, and

Table 1. History of Onshore Oil and Gas Development in Alaska and a Summary of Production to Date

Basin/Province	No. of Exploration Wells	Date of First Exploratory Well	Date of Last Exploratory Well	Date of First Commercial Discovery	No. of Fields Discovered Oil	No. of Fields Discovered Gas	No of Producing Fields Oil	No of Producing Fields Gas	Date of First Production Oil	Date of First Production Gas
Arctic (North Slope)	200	1944	1981	1968	4(a)	8	1	1(b)	1977	1949
Cook Inlet	250	1902	1981	1958	7	15	6	6(c)	1958	1958
Gulf of Alaska (onshore)	70(d)	1902	1969	1902	1	0	1	0	1902	--
Alaska Peninsula/ Bristol Bay	24	1902	1981	--	--	--	--	--	--	--
Yukon-Kandik	3	1976	1977	--	--	--	--	--	--	--
Yukon-Koyukuk-Bethel	2	1961	1961	--	--	--	--	--	--	--
Copper River	10	1957	1981	--	--	--	--	--	--	--
Selawik/Hope	2			--	--	--	--	--	--	--

Basin/Province	No. of Producing Wells	Major Facilities Constructed	Estimated Proven Reserves Prior to Production Oil (mmbbl)	Estimated Proven Reserves Prior to Production Gas (bcf)	Cumulative Production Through 1978 Oil (mmbbl)	Cumulative Production Through 1978 Gas (bcf)	1978 Production Oil (mmbbl)	1978 Production Gas (bcf)
Arctic (North Slope)	152 Prudhoe 7 S.Barrow	799 mi. pipeline w/8 stations Valdez crude terminal	1500 Kuparuk(e) 9600 Prudhoe	26500 Prudhoe 18 S.Barrow	398 Prudhoe	0.011 S.Barrow	527 Prudhoe	0.009 S.Barrow(b)
Cook Inlet	243	See Tables 6 & 7	Not known	7500	848	2304(f)	50.1	0.166
Gulf of Alaska	28	None	--	0	0.15	0	0	0
Alaska Peninsula/ Bristol Bay	--	None	--	--	--	--	--	--
Yukon-Kandik	--	None	--	--	--	--	--	--
Yukon-Koyukuk-Bethel	--	None	--	--	--	--	--	--
Copper River	--	None	--	--	--	--	--	--

Notes: (a) Kuparuk listed separately but not separate pools in Prudhoe Bay field.
(b) South Barrow gas field. Produced gas at Prudhoe is currently reinjected.
(c) Includes associated gas in oil fields.
(d) Includes 28 wells in Katalla field.
(e) Kupark oil production is scheduled to commence in 1982 at a rate of 80,000 b/d.
(f) Non-associated gas.

Kanatak and Iniskin-Chinitna on the Alaska Peninsula. In the Controller Bay area, exploration resulted in the discovery of the Katalla field in 1902.

2. The second phase of exploration commenced after Congress passed the Mineral Leasing Act (1920) and continued into the early 1930s. This phase involved exploration in the Alaska Peninsula - Cook Inlet region (Iniskin-Chinitna district) and along the Gulf of Alaska rim in the Yakataga area. Also, during this period the 37,000-square mile Naval Petroleum Reserve No. 4 (NPR-4; now known as the National Petroleum Reserve-Alaska) was set aside on the North Slope by Presidential Order in 1923, and geologic and geographical surveys began there.

3. The third phase of exploration began in 1944 with the start of the Navy's exploration program in NPR-4. Alaska's oil and gas potential was confirmed with the discovery of a number of noncommercial oil fields in the reserve and later, in 1957, with the discovery of the Swanson River field on the Kenai Peninsula. Also in 1957, lands on the North Slope, previously withheld under Public Order No. 82, were opened for leasing. Activities in the late 1960's centered in Cook Inlet as further oil and gas fields were discovered and onshore terminal, refinery, and petrochemical facilities were constructed. During the 1960s, exploration on the North Slope by private industry culminated in the discovery of the Prudhoe Bay field in 1968.

A fourth phase of petroleum development could be said to have commenced following the Prudhoe Bay discovery in 1968. This phase is dominated by the development of the Prudhoe Bay field and trans-Alaska pipeline. This development was punctuated by a delay during the period 1970-74 resulting from environmental requirements of NEPA, Alaska native claims, and the right-of-way restrictions of the Minerals Leasing Act of 1920. Exploration on State leases west and east of Prudhoe Bay continued through the 1970's while activities on Federal lands were stalled because the issuance of Federal leases had stopped in 1966. Spurred by the Arab oil embargo of 1973-74, congress expedited construction of the pipeline and mandated a new exploration program in NPR-4.

Ranking of Petroleum Provinces

The principal determinant of the future development sequence onshore in Alaska will be the scheduling of future lease sales (which may not be in order of resource potential), and with success, or lack thereof, of exploratory drilling. Assuming commercial discoveries, the lead time from discovery to first production will vary according to such factors as location, the availability and proximity of existing petroleum facilities, and the technical and environmental constraints on construction activities.

New discoveries in Cook Inlet, for example, can probably be brought into production more rapidly (perhaps 2 years) than most of the other petroleum provinces in Alaska because of the existing infrastructure and less rigorous environmental constraints on construction activities. Discoveries from a remote Arctic location such as the Selawik Lowlands would take considerably longer (perhaps as long as 10 years).

The onshore areas most likely to be developed in the 1980s are the Arctic Coastal Plain, Cook Inlet, and Northern Foothills provinces due to their high resource potential and proximity to existing petroleum facilities. Because of more extensive geologic data, there is also more certainty in the potential of these areas than the less explored interior and western Alaska basins. These three areas have, therefore, been assigned to category A indicating priority (early) development. Following passage of ANILCA, Federal lease sales offering up to a total of 2 million acres are scheduled for NPRA in December 1981 and May 1982. A lease sale schedule for other onshore Federal lands is due to be announced in late 1981.

The second group of provinces (B) should be considered far more speculative relative to the likelihood, scheduling and magnitude of development. With the exception of the Bristol Bay and Alaska Peninsula provinces, the resources of these provinces as estimated by the U. S. Geological Survey (USGS) could prove to be marginal or uneconomic because they are for the most part distant from existing infrastructure and tidewater.

The third group of provinces (C) have minimal potential and are unlikely to experience any development in the foreseeable future.

Resource Potential of the Wildlife Refuges

There is limited available data on the distribution of oil and gas resources within Alaska's petroleum provinces and basins to enable a definitive ranking of the resource potential of the wildlife refuges or estimate of the quantity of recoverable oil and gas. However, for the wildlife refuges and monuments in existence as of February 1980 the following qualitative and relative ranking can be made:

High

1. Arctic National Wildlife Range
2. Kenai National Moose Range

Medium

3. Yukon Flats National Wildlife Monument

Low

4. Koyukuk National Wildlife Refuge
5. Yukon Flats National Wildlife Refuge
6. Yukon Delta National Wildlife Refuge
7. Selawik National Wildlife Refuge
8. Clarence Rhodes National Wildlife Refuge
9. Other Refuges

The above ranking is relative and should not be construed as an estimate of absolute potential. These are vast areas generally lacking in detailed geologic data.

CHAPTER 3

PETROLEUM INDUSTRY FIELD PRACTICES AND POTENTIAL IMPACTS ON FISH AND GAME

ENVIRONMENTAL DISTURBANCES RESULTING FROM PETROLEUM INDUSTRY PRACTICES

For the purpose of this discussion, a disturbance is defined as a physical alteration of the natural environment that could ultimately cause a negative impact to fish, wildlife or their habitat. Tables 2 and 3 list the kinds of environmental disturbance that may occur as a result of petroleum industry practices within two primary Alaska environments: (1) treeless, permafrost terrain and (2) forested, non-permafrost terrain. These tables employ a subjective numerical rating system to evaluate the severity of disturbances resulting from a particular activity. The analysis contained within these tables and the subsequent discussion assumes that special environmental protection and mitigation measures are not employed beyond those that would be employed on a strictly pragmatic basis by the operator out of concern for his own interests. In other words, this section of the report considers environmental disturbances that could potentially occur as a result of petroleum industry practices under a "worst case" situation.

It should be emphasized that the numerical ratings used in Tables 2 and 3 are subjective and highly generalized and are intended only to provide a comparative indication of the severity of environmental disturbances. The severity of any particular perturbation is strongly dependent on many site-specific conditions, the construction techniques and equipment employed, and time of year at which the activity occurs.

Most disturbances are common to all phases of petroleum activity. For example, some noise disturbance occurs with nearly all activities; only the degree of disturbance varies from activity to activity. Therefore, the following phase by phase discussion will emphasize the differing degrees of disturbance that are associated with specific stages in the petroleum development process.

Table 2: Environmental Perturbations That May Occur As A Result Of Petroleum Industry Practices Within Treeless, Permafrost Terrain[a]

ENVIRONMENTAL PERTURBATIONS[b]		EXPLORATION																						DEVELOPMENT																						PRODUCTION												TERMINATION											
		Geophysical Survey							Drilling															Production Facility Construction											Pipeline Construction											Field Operation							Pipeline Operation											
		Overland Travel	Stream Crossings	Seismic Wave Production	Remote Area Human Support	Air Traffic	Accidents	Regional Population Increase	Overland Travel incl. Stream Xings	Access Road Construction	Airstrip Construction	Drill and Camp Site Develop.	Gravel Mining	Drilling & Related Activities	Remote Area Human Support	Air Traffic	Accidents	Regional Population Increase	Overland Travel	Access Road Construction	Site Development (all fac.)	Gravel Mining	Drilling	Mechanical Facilities Constr.	Gathering Pipeline Constr.	Remote Area Human Support	Air Traffic	Accidents	Regional Population Increase	Access Road Construction	Right-of-way Development	Stream Crossings	Gravel Mining	Pump Station Construction	Pipe Laying	Restoration	Remote Area Human Support	Air Traffic	Accidents	Regional Population Increase	Road Travel	Operation of Mechanical Facil.	Permanent Human Support	Air Traffic	Accidents	Local Population Increase	Regional Population Increase	Development of Ancillary Indust.	Road Travel	Operation of Mechanical Facil.	Presence of Above Ground Pipe	Gravel Mining	Permanent Human Support	Air Traffic	Accidents	Regional Population Increase	Road Travel	Removal of Equipment	Gravel Removal and Stockpile	Terrain Rehabilitation	Revegetation	Remote Area Human Support	Air Traffic	Accidents
Land Surface Disturbances	Destruction of Vegetation	3			1				3	2	2	2	2						1	3	3	2			2				3	3		2	1	-2																								-2					
	Tree Clearing																																																														
	Slash Disposal																																																												
	Altered Soil Characteristics	1							1	2	2	2	2						1	3	2	3			1				2	1		3	1																								-1	-1					
	Thermal Erosion/Thermokarst	3			2				3										1		1				1				1	2				2	-2																								-1					
	Hydraulic Erosion	3			1				3	1			1	2					1	1	1	2			2				2	3	2	2	1	2	-2																								-2					
	Altered Surface Water Hydrology	1							1	2	1	1	1						1	3	2	1			3				3	3		1		2																								-1	-1					
	Fill Over Land Surface									2	2	2								2	3				1				3	3			1																								-2					
	Above Ground Obstructions									1	1	1		1						2	2		1	1	3	1			2	2			1	3																								-2	-1					
Stream or Lake Disturbances	Stream Bank Erosion		2						2	1			2						1	1		2			1				1		2	2		-2																														
	Siltation		2						2	1			3						1	1		3			2				1		3	3																														
	Channel Constriction									1			1							1		1							1		1	1																														
	Altered Current Velocity									1			1							1		1							1		1	1																														
	Channel Obstruction		1						1	1										1					1				1		1																														
	Shock Wave			3																													2																												
	Perched Drainage Structure									2										3									3																																
	Bottom Substrate Disturbance		2						2	1			3						1	1		3			2				1		3	3																														
	Long Term Channel Changes									1			2							1		2							1		2	2																														
	Reduced Water Volume				1																				2										2																										
	Altered Water Quality				1																				2										2																										
	Drainage of Lake Basin	1																																																												
Noise and Activity	Loud Noise (Blasting,Aircraft,Etc)			3		2									2						1				3							3			2						2	3																				
	Moderate Noise	2		1	2	1			2	2	2	2	2	2	2	2			1	2	3	2	2	2	2	2			2	2	2	2	2	2	2	2	2			3	2	2	2				2	2	1	1	1	1			2	2	2	2	1	1	1	
	Human Activity	1		1	2	1			1	1	1	1	1	2	1	2			1	2	3	1	2	2	2	1	2		2	2	2	1	2	3	2	1	2			3	2	2	2				2	2		1	1	1			2	2	2	2	1	1	1	
Land Pollution	Oil and Fuel Spills						1									2					2					3										3						2																				1
	Toxic Chemical Spills															2					2					3										2						2																				1
	Drilling Fluid													2								2				2																																				
	Domestic Solid Waste Litter	1			1										2				1					2										2						2																				1	
	Edible Substance Availability	1			1										2				1					2										3						2																				1	
Water Pollution	Suspended Sediment	1								1			3						1	2		3			2				2		3	3																														
	Oil and Fuel Spills						1									2					2					3										2						2																				1
	Toxic Chemical Spills															2					2					3										2						2																				1
	Drilling Fluid																																																													
	Sanitary Waste Effluent				2									2		2								2		2										2		2				2																				1
Air Pollution	Dust Generation									2	2	2	1		1	2				3	2	1		2	1	1	2			3	2	1	1	2	2	1	1	2			3		1	2				2		1	1	1			2	2	2	2	1		1	
	Emissions from Int. Combustion Eng.	1			1					1	1	1	1		1	2				2	2	1		2	1	1	2			2	2	2	1	2	2	1	1	2			1		1	2				1		1	1	1			1	1	1	1	1	1	1	
	Emissions from Major Facilities																																									2												2									
	Incinerator and Burn Smoke				1									2										2										2							2										1									
Indirect Human Activities	Hunting and Fishing				1		1							1		2								1		3										1		3				2	3	2																		
	Intensified Land Use Demands						1									2										3										1		3				2	3	2																		
	Incr. Domestic Waste Processing						1									2										3										1		3				2	3	2																		
TOTALS		19	7	8	17	4	2	3	21	26	14	15	27	7	14	9	10	6	12	35	33	28	7	9	27	19	11	16	9	37	25	25	28	13	23	-2	19	9	12	9	10	8	14	11	10	6	9	6	7	6	4	15	11	6	6	3	7	7	1	4	-2	10	6	5	778

(a) Assumes that the area is sufficiently remote to require full human support facilities.

(b) The rating system is based on a subjective scale of 0-3 with 3 representing maximum detrimental impact. Negative values represent beneficaial impact.

Table 3: Environmental Perturbations That May Occur As A Result Of Petroleum Industry Practices Within Forested, Non-Permafrost Terrain[a]

EXPLORATION

ENVIRONMENTAL PERTURBATIONS[b] / PETROLEUM DEVELOPMENT PHASE AND ACTIVITY		Geophysical Survey							Drilling									
		Overland Travel	Stream Crossings	Seismic Wave Production	Remote Area Human Support	Air Traffic	Accidents	Regional Population Increase	Overland Travel incl. Stream Xings	Access Road Construction	Airstrip Construction	Drill and Camp Site Develop.	Gravel Mining	Drilling & Related Activities	Remote Area Human Support	Air Traffic	Accidents	Regional Population Increase
Land Surface Disturbances	Destruction of Vegetation	2							2	3		2	1					
	Tree Clearing	3							2	2		2	1					
	Slash Disposal	2							1	1		1	1					
	Altered Soil Characteristics	1							1	2		1	1					
	Thermal Erosion/Thermokarst																	
	Hydraulic Erosion	3							3	2		1	1					
	Altered Surface Water Hydrology	1							1	2		1	1					
	Fill Over Land Surface									2		1						
	Above Ground Obstructions									1		1		1				
Stream or Lake Disturbances	Stream Bank Erosion		2						2	1			1					
	Siltation		2						2	1			2					
	Channel Constriction									1			1					
	Altered Current Velocity									1			1					
	Channel Obstruction		1						1	1								
	Shock Wave			3														
	Perched Drainage Structure									2								
	Bottom Substrate Disturbance		2						2	1			2					
	Long Term Channel Changes									1			1					
	Reduced Water Volume																	
	Altered Water Quality																	
	Drainage of Lake Basin																	
Noise and Activity	Loud Noise (Blasting,Aircraft,Etc)			3		1										1		
	Moderate Noise	2		1					2	2		2	2	2		1		
	Human Activity	1		1		1			1	1		1	1	2		1		
Land Pollution	Oil and Fuel Spills						1										2	
	Toxic Chemical Spills																2	
	Drilling Fluid													2				
	Domestic Solid Waste Litter	1																
	Edible Substance Availability	1													1			
Water Pollution	Suspended Sediment	1								1			2					
	Oil and Fuel Spills						1										2	
	Toxic Chemical Spills																2	
	Drilling Fluid																	
	Sanitary Waste Effluent																	
Air Pollution	Dust Generation									2		2	1					
	Emissions from Int. Combustion Eng.	1								1		1	1					
	Emissions from Major Facilities																	
	Incinerator and Burn Smoke																	
Indirect Human Activities	Hunting and Fishing							1										2
	Intensified Land Use Demands							1										2
	Incr. Domestic Waste Processing							1										2
	TOTALS	19	7	8	0	2	2	3	20	31	0	16	21	7	1	3	8	6

DEVELOPMENT

ENVIRONMENTAL PERTURBATIONS[b]		Production Facility Construction											Pipeline Construction										
		Overland Travel	Access Road Construction	Site Development (all fac.)	Gravel Mining	Drilling	Mechanical Facilities Constr.	Gathering Pipeline Constr.	Remote Area Human Support	Air Traffic	Accidents	Regional Population Increase	Access Road Construction	Right-of-way Development	Stream Crossings	Gravel Mining	Pump Station Construction	Pipe Laying	Restoration	Remote Area Human Support	Air Traffic	Accidents	Regional Population Increase
Land Surface Disturbances	Destruction of Vegetation	1	3	3	1			2					3	3		1	1		-2				
	Tree Clearing			2	1								2	3		1	1						
	Slash Disposal			1	1								1	2		1	1						
	Altered Soil Characteristics	1	2	1	2			1					2	1		2	1						
	Thermal Erosion/Thermokarst																						
	Hydraulic Erosion	1	2	1	1			2					2	3	2	1	1	2	-2				
	Altered Surface Water Hydrology	1	3	2	1			2					3	3		1		2					
	Fill Over Land Surface		1	2									3	2			1						
	Above Ground Obstructions		2	2		1	1						2	1			1	1					
Stream or Lake Disturbances	Stream Bank Erosion	1	1		1			1					1		2	1			-2				
	Siltation	1	1		2			2					1		3	2							
	Channel Constriction		1		1								1		1	1							
	Altered Current Velocity		1		1								1		1	1							
	Channel Obstruction		1					1					1		1								
	Shock Wave																	2					
	Perched Drainage Structure		3										3										
	Bottom Substrate Disturbance	1	1		2			2					1		3	2							
	Long Term Channel Changes		1		1								1		2	1							
	Reduced Water Volume																						
	Altered Water Quality																						
	Drainage of Lake Basin																						
Noise and Activity	Loud Noise (Blasting,Aircraft,Etc)			1						2								3			2		
	Moderate Noise	1	2	3	1	2	2	2		1			2	2	2	1	2	2	2		2		
	Human Activity	1	2	3	1	2	2	2		1			2	2	2	1	2	3	2		2		
Land Pollution	Oil and Fuel Spills			2							3											3	
	Toxic Chemical Spills			2							3											2	
	Drilling Fluid					2					2												
	Domestic Solid Waste Litter	1																		1			
	Edible Substance Availability	1							1											2			
Water Pollution	Suspended Sediment		2		2			2					2		3	2							
	Oil and Fuel Spills			2							3											3	
	Toxic Chemical Spills			2							3											2	
	Drilling Fluid																						
	Sanitary Waste Effluent																					1	
Air Pollution	Dust Generation		2	1	1		2	1					2	2	1	1	2	2	1		2		
	Emissions from Int. Combustion Eng.		2	2	1		2	1					2	2	2	1	2	2	1		1		
	Emissions from Major Facilities																						
	Incinerator and Burn Smoke																						
Indirect Human Activities	Hunting and Fishing											3											3
	Intensified Land Use Demands											3											3
	Incr. Domestic Waste Processing											3											3
	TOTALS	11	33	32	21	7	9	21	1	4	14	9	38	26	25	21	15	19	0	3	9	11	9

PRODUCTION / TERMINATION

ENVIRONMENTAL PERTURBATIONS[b]		Production: Field Operation							Production: Pipeline Operation									TERMINATION								
		Road Travel	Operation of Mechanical Facil.	Permanent Human Support	Air Traffic	Accidents	Local Population Increase	Regional Population Increase	Development of Ancillary Indust.	Road Travel	Operation of Mechanical Facil.	Presence of Above Ground Pipe	Gravel Mining	Permanent Human Support	Air Traffic	Accidents	Regional Population Increase	Road Travel	Removal of Equipment	Gravel Removal and Stockpile	Terrain Rehabilitation	Revegetation	Remote Area Human Support	Air Traffic	Accidents	
Land Surface Disturbances	Destruction of Vegetation												1									-2				
	Tree Clearing																					-1				
	Slash Disposal																				-1					
	Altered Soil Characteristics												1							-1	-1					
	Thermal Erosion/Thermokarst																									
	Hydraulic Erosion												1									-2				
	Altered Surface Water Hydrology												1							-1	-1					
	Fill Over Land Surface																			-1						
	Above Ground Obstructions																			-2	-1					
Stream or Lake Disturbances	Stream Bank Erosion												1								-1	-1				
	Siltation												1													
	Channel Constriction												1													
	Altered Current Velocity												1													
	Channel Obstruction																									
	Shock Wave																									
	Perched Drainage Structure																									
	Bottom Substrate Disturbance												1													
	Long Term Channel Changes												1													
	Reduced Water Volume													1												
	Altered Water Quality													1												
	Drainage of Lake Basin																									
Noise and Activity	Loud Noise (Blasting,Aircraft,Etc)		2		2										2									1		
	Moderate Noise	3	2		1					2	2		1	1	1			2	2	2	2	1		1		
	Human Activity	3	2		1					2	2		1	1	1			2	2	2	2	1		1		
Land Pollution	Oil and Fuel Spills					2										3									1	
	Toxic Chemical Spills					2																			1	
	Drilling Fluid																									
	Domestic Solid Waste Litter													1												
	Edible Substance Availability													2									1			
Water Pollution	Suspended Sediment												1								1					
	Oil and Fuel Spills					2										3									1	
	Toxic Chemical Spills					2																			1	
	Drilling Fluid																									
	Sanitary Waste Effluent													1												
Air Pollution	Dust Generation	3			1					2			1	1	1			2	2	2	1	1				
	Emissions from Int. Combustion Eng.	1			1					1			1	1	1			1	1	1	1	1				
	Emissions from Major Facilities		2								2															
	Incinerator and Burn Smoke													1												
Indirect Human Activities	Hunting and Fishing						2	3	2								1									
	Intensified Land Use Demands						2	3	2								1									
	Incr. Domestic Waste Processing						2	3	2								1									
	TOTALS	10	8	0	6	8	6	9	6	7	6	0	15	11	6	6	3	7	7	2	2	-2	1	3	4	623

(a) Assumes that the area is sufficiently near to existing population centers sucn that full human support facilities are not required

(b) The rating system is based on a subjective scale of 0-3 with 3 representing maximum detrimental impact. Negative values represent beneficial impact.

POTENTIAL BIOLOGICAL EFFECTS OF PETROLEUM RELATED ENVIRONMENTAL DISTURBANCE

Overview

The preceding part of this chapter discussed environmental alterations that can occur as a result of various petroleum industry practices. This section discusses the possible effects to fish and wildlife resources or their habitats that can occur as a result of those disturbances. It should be emphasized that the severity of biological effects is highly site-specific, depending on species present, site characteristics, and the nature of the disturbance. Therefore, an attempt is not made to relate effects on fish and wildlife to broad regional differences. Regional variation in the severity of disturbance does, however, affect impacts on biological resources and should be considered.

Table 4 presents categories of biological impacts that can potentially result from various physical alterations. Formal documentation of actual biological effects resulting from petroleum industry activity in Alaska has only been undertaken in a few situations.

Table 4:

Potential Impacts To Fish and Wildlife That Could Occur As A Result of Petroleum Industry-Related Environmental Perturbations

ENVIRONMENTAL PERTURBATIONS		ALTERATION OF TERRESTRIAL HABITAT: Direct Habitat Loss — Reduced Primary Productivity	Wildlife Range Reduction	Displacement of Low Mobility Species	Elimination of Critical Habitat	Interruption of Energy & Nutrient Flow	ALTERATION OF TERRESTRIAL HABITAT: Altered Habitat Charac. — Reduced Plant Cover & Productivity	Altered Community Composition	Altered Wildlife Use	Outbreaks of Pest Organisms	Interruption of Energy & Nutrient Flow	ALTERATION OF TERRESTRIAL HABITAT: Interfer. With Movements — Interruption of Critical Life History Stages	Prevention of Access to Critical Habitats	High Energy Expenditure-Lowered Survival	Injury to Flying Birds	Death or Injury from Toxic Substances	ALTERATION OF AQUATIC HABITAT: Direct Habitat Loss — Reduced Productivity	Displacement of Low Mobility Species	Elimination of Critical Fish Habitat	Interruption of Energy & Nutrient Flow	ALTERATION OF AQUATIC HABITAT: Altered Habitat Charac. — Reduced Productivity	Reduction of Critical Fish Habitat	Reduction of Fish Food Organisms	Interruption of Energy & Nutrient Flow	ALTERATION OF AQUATIC HABITAT: Interfer. With Movements — Blockage of Spawning Migration	Blockage of Access to Feeding Habitat	Prevention of Escape from Adverse Habitat	High Energy Expenditure-Lowered Survival	Interruption of Energy & Nutrient Flow	Death or Injury to Fish or Eggs	DISTURBANCE OF WILDLIFE (Noise, etc) — Short Term Displacement of Mobile Species	Long Term Displacement-Range Reduction	Displacement of Some Population Segments	Displacement from Critical Habitat	Increased Stress-Lowered Survival	Interruption of Critical Life History Stages	Interruption of Energy & Nutrient Flow	ATTRACTION OF WILDLIFE — Poor Survival Upon Removal of Food Source	Man Induced Mortality if Nuisance Animal	Altered Behavior Passed on to Progeny	Imbalance Between Pop. Size & Food Supply	Breakdown in Natural Social Structure	Increased Stress-Lowered Survival	HUMAN EXPLOIT. — Increased Fish Mortality	Increased Wildlife Mortality
Land Surface Disturbances	Destruction of Vegetation	X	X	X	X	X	X	X	X		X																																
	Tree Clearing	X	X		X	X	X	X	X		X																																
	Slash Disposal						X		X	X																																
	Altered Soil Characteristics						X	X	X		X																																
	Thermal Erosion/Thermokarst	X	X	X	X	X	X	X	X		X																																
	Hydraulic Erosion	X	X	X	X	X	X	X	X		X										X	X	X	X																			
	Altered Surface Water Hydrology						X	X	X		X																																
	Fill Over Land Surface	X	X	X	X	X						X	X	X																													
	Above Ground Obstructions											X	X	X	X																												
Stream or Lake Disturbances	Stream Bank Erosion	X	X		X		X	X	X								X	X	X	X	X	X	X	X																			
	Siltation																X	X	X	X	X	X	X	X																			
	Channel Constriction																X	X	X		X	X	X		X	X	X	X	X														
	Altered Current Velocity																X	X	X		X	X	X		X	X	X	X	X														
	Channel Obstruction																X	X	X		X	X	X		X	X	X	X	X														
	Shock Wave																												X														
	Perched Drainage Structure						X	X	X		X						X		X	X	X	X	X		X	X	X	X	X														
	Bottom Substrate Disturbance																X	X	X	X	X	X	X	X																			
	Long Term Channel Changes						X	X	X								X	X	X	X	X	X	X	X																			
	Reduced Water Volume																X	X	X	X	X	X	X	X	X	X	X	X	X	X													
	Altered Water Quality																				X	X	X	X																			
	Drainage of Lake Basin																X	X	X	X																							
Noise and Activity	Loud Noise (Blasting,Aircraft,Etc)		X		X				X																										X	X	X	X	X	X	X								
	Moderate Noise		X		X				X																										X	X	X	X	X	X	X								
	Human Activity		X		X				X																										X	X	X	X	X	X	X								
Land Pollution	Oil and Fuel Spills	X	X	X	X	X	X	X	X		X					X																																
	Toxic Chemical Spills	X	X	X	X	X	X	X	X		X					X																																
	Drilling Fluid	X	X	X	X	X	X	X	X		X																																					
	Domestic Solid Waste Litter						X	X	X																																							
	Edible Substance Availability																																													X	X	X	X	X	X
Water Pollution	Suspended Sediment																				X	X	X	X																				
	Oil and Fuel Spills																X	X	X	X	X	X	X	X						X														
	Toxic Chemical Spills																X	X	X	X	X	X	X	X						X														
	Drilling Fluid																X	X	X	X	X	X	X	X																				
	Sanitary Waste Effluent																				X	X	X	X																				
Air Pollution	Dust Generation						X	X	X		X										X			X																				
	Emissions from Int. Combustion Eng.						X																															X								
	Emissions from Major Facilities						X	X	X		X					X																						X								
	Incinerator and Burn Smoke																																				X								
Indirect Human Activities	Hunting and Fishing																																												X	X
	Intensified Land Use Demands	X	X	X	X	X	X	X	X		X										X	X	X	X												X	X	X	X	X	X	X								
	Incr. Domestic Waste Processing																				X	X	X	X																				

CHAPTER 4

TWO CASE STUDIES OF PETROLEUM DEVELOPMENT AND ENVIRONMENTAL PROTECTION IN ALASKA

INTRODUCTION

This chapter deals with historical cases of petroleum operations and environmental protection: the Kenai National Moose Range (KNMR)[1] and the National Petroleum Reserve in Alaska (NPRA). These areas are located in the two major established petroleum regions of the State. The main purpose of the two case studies is to show how fish and wildlife values and interests have actually fared in the context of two impact mitigation programs -- one where the FWS has had primary authority for surface protection and the other where it is a secondary player. Both the Moose Range and the Petroleum Reserve examples assess (1) administrative authorities, roles, and decision-making, (2) environmental protection requirements and enforcement procedures, and (3) environmental impacts and mitigation to the extent that limited information on actual biological impacts allows.

The two cases also cover certain features peculiar to each. The KNMR study gives special attention to pre-lease policy issues, and land classification activities of the 1950's. The NPRA study reviews experiences under the Navy's 1944-53 exploration program and the shift of jurisdiction over the reserve from the Navy to the Department of the Interior in 1977. In both cases the common purpose is to assess the role and effectiveness of fish and wildlife protection interests under varying institutional, environmental, and impact conditions.

The basic institutional difference between the two cases is that, in the Moose Range, the FWS has had primary authority for surface resource management while the USGS regulates drilling and production (subsurface) activities only; in the Petroleum Reserve, FWS has had only a secondary, advisory role in a government exploration program that is both controlled and carried out (under contract with private firms) primarily by the USGS, which divides surface management authority with the BLM. Other institutional and procedural differences are derived from the different historical settings of

(1) The Kenai National Moose Range was redesignated as the Kenai National Wildlife Refuge under ANILCA which increased its size by approximately 250,000 acres. However, to maintain historical perspective, this report has retained the original designation.

the two cases: In the KNMR, petroleum operations peaked in the early 1960's, before the advent of the modern environmental movement and passage of the National Environmental Policy Act of 1969 (NEPA); in contast, in the petroleum reserve the current USGS exploration program was devised in the mid-1970's, several years after NEPA and other environmental protection measures had been established, although the earlier (1944 - 1953) Navy exploration program occured well before NEPA.

The respective environmental settings also distinguish the two cases. The NPRA stretches widely across the tundra of the arctic coastal plain and Brooks Range foothills, all underlain with permafrost. Petroleum operations in the KNMR have, in contrast, occurred in the permafrost-free, forested lowlands of the northwestern Kenai Peninsula. These differences have significant implications for the types of physical and biological impact problems encountered in each area. Related to these environmental and impact differences are differences in the nature of the petroleum operations in each situation: intensive exploration and development activities, together with production that has continued for two decades, on the Kenai Peninsula, while only exploration activities, consisting of widely scattered geophysical and exploratory drilling operations, have occurred on the arctic coastal plain and foothills of the petroleum reserve.

One of the basic purposes of the case studies is to show how differences such as these have affected environmental protection objectives and interests in government surveillance of petroleum operations in two of Alaska's major oil and gas provinces.

CONCLUSIONS

Because of the possibility of future petroleum development on other Federal lands in Alaska, it is important to assess what the KNMR and NPRA case studies tell us about conditions affecting achievement of environmental protection objectives and about the parts that fish and wildife values and interests may play in petroleum impact mitigation programs. The following sections present major conclusions about authorities and roles, decision-making, stipulations and their enforcement, and impacts and mitigation. We try to account for relevant differences in the historical contexts, environmental settings, and petroleum project characteristics of the two cases.

Authorities and Roles

The case studies show most clearly that when petroleum activity takes place on refuge lands, the FWS can exercise substantial control, to the extent allowed by higher departmental authority and the legal rights associated with lease holding. Such is the situation in the KNMR, where the refuge manager possesses authority over petroleum operators, including suspension and shut-down powers, that not even the BLM authorized officers hold on public domain lands.

Outside of refuge lands, such as on the NPRA in Alaska, the FWS role in surface management is closely circumscribed, indirect, incomplete and fragmented. It is limited for the most part to advisory comments and recommendations, usually to BLM and the USGS, for fish and wildlife and surface protection measures. Unless FWS can bring its own sources of authority to bear -- such as the Endangered Species Act or the Fish and Wildlife Coordination Act -- the agency depends almost entirely on BLM and USGS to see that fish and wildlife protection interests are accounted for in the regulation of petroleum operations.

In the Petroleum Reserve it is not even clear that FWS has more effective authority than BLM for the protection of the endangered peregrine falcons of the Colville River bluffs special area. There, the principal regulatory tools are BLM's surface management guidelines and its permitting authority. Thus, FWS officials often must look not only to their own statutes and regulations for authorities supporting their participation in environmental management and regulatory programs; they must also look for leverage in the regulatory authorities of other Federal agencies.

A good example is the Corps of Engineers' Section 404 permits for dredging and filling in navigable waters and related wetlands. The FWS exercises their review and comment prerogatives under the Fish and Wildlife Coordination to influence the conditions under which Section 404 permits are granted. In NPRA, such conditions could cover the uses and locations of gravel pads on the tundra wetlands of the extensive coastal plain, an area that provides habitat for many thousands of waterfowl and shorebirds. This, of course, is why FWS has strong interest in seeing the disagreement between USGS and the Corps over the applicability of Section 404 to the NPRA exploration program resolved in favor of the Corps.

In the situation of TAPS construction, the FWS had a similar self-interest in the authority of Alaska's Department of Fish and Game to regulate activities affecting anadromous fish streams. This "Title 16" authority, which was effectively exercised in the TAPS case, provided FWS and other environmental monitors with access to, and indirect authority over, construction activities that might otherwise have been beyond their reach. In the NPRA case, however, neither Title 16 nor other environmental regulatory powers of State agencies have been able to fill critical voids in FWS's own structure of authority. This has occurred for several reasons: (1) the exploration program has generally avoided practices and situations that would require State permits of particular interest to FWS; (2) USGS, which has primary authority in the NPRA program, has disputed certain jurisdictional claims of the State on Federal lands (e.g., over water withdrawals and gravel mining); and (3) State government agencies, short on funds and manpower for surveillance work, have tended to defer to Federal authority and to surface management by BLM.

In the situation of the KNMR, where development activity peaked in the early 1960's, little of the present Federal and State environmental management authority yet existed or was developed and in place. But here

such supplementary and indirect protection powers were not necessary for FWS to effectively manage its own domain of national wildlife refuge lands.

The two agencies have relatively clearcut and distinctive roles, and they serve as government regulators of private industrial operations. In NPRA, in contrast, USGS not only is the primary governmental authority for exploration and related surface management in extensive "areas of operations," but it is also the principal operator, and it uses a private company under contract to carry out government, not private, exploration activities. USGS thus plays a unique and relatively autonomous lead role in the National Petroleum Reserve, while all other agencies (including BLM and FWS) occupy various secondary positions.

Decisionmaking

The Kenai and NPRA case studies reveal two quite distinctive levels of decisionmaking affecting environmental values and the status of different government agencies in resource management programs. The first consists of policy decisions made at high levels of government that determine priorities and allocate authorities and roles to affected agencies and interests. These decisions can be very far-reaching in their consequences, establishing directions and limits for a continuing chain of further developments.

A second level of decisions is found in subsequent phases of program planning and operations. This is the level where specific decisions are made about locations for camps, drill sites, and gravel borrows, about transport routes, activity schedules, construction methods, and the many other elements that comprise a plan of operations. In the preparation, review, and approval of plans of operations, many decisions are made affecting specific fish and wildlife and other environmental values.

In the case of the KNMR, the key policy decisions were those to allow oil and gas leasing in the Range, to prepare and promulgate regulations setting terms for leasing, and to require classification of the refuge lands as suitable or unsuitable for leasing.

The decision to allow leasing in the range was made at the secretarial level (under the Mineral Leasing Act of 1920, this is a matter of secretarial discretion). The Secretary of the Interior in the early 1950's apparently was predisposed to leasing in the KNMR and elsewhere on national wildlife refuge lands. Under permissive laws and regulations, the secretary presided over a series of events that began with the issuance of KNMR leases to the Richfield Oil Company and others, and continued with Richfield's subsequent discovery of oil at Swanson River in 1957. The discovery resulted in intensive pressures to expand leasing, which was done under a new set of leasing regulations promulgated in 1958.

The 1958 regulations, which are still in effect today, required that the land in "Alaska wildlife areas" be classified by FWS and BLM before leasing. Both classification and joint authority of FWS and BLM are critical

points. The refuge manager carried out the classification action under higher level review and guidance, with minimal BLM participation. FWS was thus able to segregate high quality habitat areas from others where leasing might take place. Later, however, when FWS sought to set aside further acreage for habitat protection, BLM asserted its authority under the 1958 regulations and balked at FWS's classification proposals.

From secretarial decision down to land classification, FWS was bound by higher levels and outside authority, but as decisionmaking devolved to lower levels, FWS's ability to protect fish and wildlife values progressively increased. The secretarial decision was subject to no FWS control; preparation of the 1958 regulations involved FWS participation at the director's level; and land classification directly involved FWS field managers, who could press for proposals to avoid and minimize habitat loss.

In the case of NPRA, the key policy decisions were embodied in the Naval Petroleum Reserves Production Act of 1976, the 1977 cooperative procedures between USGS and BLM, and BLM's NPRA surface management regulations. The production act brought the reserve under the control of the Department of the Interior, ensuring a level of surface management protection that probably would not have been attainable under the Navy in the absence of other checks on its management prerogatives. But the act also mandated continued exploration of the reserve, stating that environmental protection objectives should be observed to the extent consistent with the exploration mandate.

Within the Department of the Interior, a key policy decision was to treat NPRA lands as if they were leased lands, thus requiring a central role for USGS under established regulations for leased lands, rather than allowing BLM to take primary jurisdiction based on its existing authority over exploration activities on public lands before they are leased. Under this secretarial-level decision, BLM's proposed regulations assigning the lead role to itself were rejected, and the cooperative procedures placing USGS into the lead became the governing instrument for NPRA program operations.

The program operations level of decisionmaking in both the KNMR and NPRA cases is largely defined by plans of operations. These plans set operational terms, including environmental protection requirements, for the exploration and development activities. In the moose range, FWS has the power to approve or disapprove of such plans and to shape pertinent details of their content. In the petroleum reserve program, in contrast, FWS can only make comments and recommendations that are subject to USGS/BLM acceptance or approval. Thus, without independent authority, the effectiveness of FWS's participation in the formal process of plan review is entirely dependent on the responsiveness of others. FWS can and should participate in an advisory role at all relevant points both in the planning process and in follow-up field inspections, but its influence on decisions remains highly contingent in the absence of any direct authority of its own or any leverage through others.

Stipulations and Enforcement

Despite major differences in the level of institutional support for environmental management programs in the two cases, in the origins of the stipulations that were employed, and in the general level of environmental sensitivity among oil companies and contractors, the two programs are very much alike in their basic methods of environmental management.

Perhaps the most striking difference between the NPRA and the KNMR situations is the large institutional commitment to the environmental program on the North Slope. For the NPRA program, the environmental staffs of USGS, BLM, and Husky Oil number some dozen individuals in professional positions, and there are researchers and other environmental program managers. On the KNMR, in contrast, the environmental program was a "one-person" operation. The refuge manager was expected to oversee oil operations as part of his routine administrative duties. In 1961 and 1962, at the peak of oil exploration and development, the entire permanent staff of the Kenai National Moose Range consisted of the manager, assistant manager, a law enforcement officer, one or two mechanics, and a clerk typist.

This disparity in institutional support for the two programs reflects, of course, the fact that KNMR oil development occurred before the environmental movement that began in the late 1960's. The KNMR experience pioneered many of the environmental management techniques that are now employed routinely by State and Federal agencies in Alaska. The management efforts on the KNMR contributed greatly to an increased awareness of, sensitivity to, and appreciation for, restrictive measures on the field operations of oil companies and their contractors. Thus, KNMR managers had to cope with the novelty of environmental stipulations, which made surveillance and enforcement a more difficult problem there in the early years than it was to be subsequently on the North Slope.

There are also important differences in the origin of the stipulations that regulate activities in the two places. In the case of NPRA, stipulations were written specifically for the arctic tundra environment on the basis of substantial past experience with surface travel and construction. These stipulations were never promulgated as regulations of any Federal agency. In contrast, the formal stipulations used by managers of the Kenai range were drafted in Washington, D.C. in 1958, before the accumulation of much experience with environmental management anywhere. As they were codified in regulations, they had to be written at a high level of generality so they would be applicable to different environmental conditions throughout the country.

Despite these differences, the two environmental management programs functioned in a remarkedly similar fashion. Fundamental to both was the ability to control, through approval of a plan of operations, the selection of routes for roads and cross-country travel, locations for stream crossings, sites for the construction of permanent and temporary facilities, including drill pads, and the timing of all field work. Also at the time of approving the plan of operations, program managers gave specific content to the more

general stipulations. Even in the NPRA case, where stipulations were prepared specifically for North Slope operations, it has been necessary to interpret and apply them on a site-specific basis. In this process, which occurs principally through approval of a plan of operations, the local knowledge and experience of the managers becomes an important determinant of the quality and content of the environmental program.

The designations of routes, sites, and seasons of work are a fundamental environmental management technique, and their enforcement presents a straightforward task. Both case studies show that the most difficult field enforcement problem is securing compliance with stipulations that are easily violated by field crews and equipment operators through accidents (e.g., survey mistakes) and carelessness. Generally, surveillance and enforcement in such cases were more difficult for managers on the KNMR than for managers on the North Slope, perhaps because of the better indoctrination in the NPRA situation and greater legitimacy and acceptance of the regulations themselves. Consequently, surveillance in NPRA has tended to focus on "housekeeping" problems of camps and work sites because of the relative infrequency of significant infractions of environmental stipulations.

Impacts and Mitigation

The success of environmental impact management efforts in NPRA since 1977, and in the KNMR since the beginning of leasing there in 1956, suggests that techniques of impact mitigation are known, tested, and effective. These techniques, when applied by people with local environmental knowledge, appear to minimize damage to fish and wildlife resources from petroleum exploration and development. USGS controlled this process in one case, FWS in the other.

A quest for more and better tools of environmental management requires research -- research that will generate information about specific physical and biological systems and the reaction of these systems to certain types of intrusions. Mitigating measures are based on understanding how oil operations affect fish, wildlife, and their habitat in various settings. It is conceivable that a better understanding of physical and biological resources could lead to entirely new stipulations and management techniques. It is more likely, however, that research will refine existing tools and their use. Indeed, greater knowledge could result in a relaxation of some stipulations that are now imposed as a hedge against possible but unknown consequences of field work.

An evaluation of environmental impacts of oil-related activity in NPRA and the KNMR cannot ignore the minuteness of the intrusions relative to the size of natural systems involved. Although NPRA is much larger than the KNMR, both contain thousands of square miles of comparatively homogeneous habitat. The NPRA has experienced only exploration activities, many of the effects of which are temporary. Development of two fields has occurred on the KNMR, but this has directly affected only a few thousand acres.

It is largely because the intrusion of the industry has been so modest vis-a-vis the environment that impacts are difficult to study with scientific precision. The intervening forces of nature are such that it is difficult to connect a change in the number or behavior of a particular species with an oil-related activity. This does not mean that we cannot speak with some confidence about the effectiveness of mitigating measures. On the basis of what we have observed in the absence of regulatory controls (during early Navy exploration for example, in NPRA, for example, and on the Alaska Peninsula during the early 1960's), we can be sure that supervision does result in much less localized environmental damage.

But mitigating measures, by their own definition, do not purport to prevent adverse impacts. Issuance of a lease or a congressional directive to explore for petroleum in a wild area represents a decision to accept unknown adverse impacts on the wildlife resources for the public and private benefits that derive from oil and gas. Thus, the only plausible objective of environmental impact management is to minimize adverse impacts, some of which may be unavoidable. Both the NPRA and KNMR case studies suggest that both of these environmental management programs have effectively accomplished this objective.

CHAPTER 5

STRENGTHENING FISH AND WILDLIFE PROTECTION ASPECTS OF PETROLEUM DEVELOPMENT SURVEILLANCE PROGRAMS

INTRODUCTION

Developments in national energy and environmental policies during the past decade have led to the emergence of multiple-objective resource management programs involving many agencies and interests. In Alaska, these have included interagency surveillance programs for construction of TAPS, petroleum leasing on the OCS, exploration of the NPRA, and prospective construction of the Alaska natural gas pipeline system. The FWS consequently must integrate its own statutory authorities for fish and wildlife protection into broader interagency systems in which planning and surveillance responsibilities are shared by several resource development and environmental protection agencies.

This section presents a summary of major findings and recommendations on the organization and processes of environmental surveillance on National Wildlife Refuges and other Federal lands in Alaska. The recommendations are directed specifically to FWS. They deal primarily with the agency's role within larger interagency networks of resource development and environmental surveillance, and they fall within the scope of existing FWS authorities for resource protection and enhancement. Previous parts of this study, particularly Chapters 1 and 4, provide the information and analytical base for the discussion and recommendations presented here.

Recommendations

Classification of Refuge Lands. Clearly, the most effective means of mitigating adverse effects of oil development on fish and wildlife resources is to prohibit such development in prime habitat, nesting and calving grounds, and other areas of ecological sensitivity. Before the issuance of oil and gas leases in the KNMR in 1958, the Fish and Wildlife Service specified that only the lowlands of the northern half of the Range (except the prime waterfowl habitat of the Chickaloon Flats) would be open to leasing. This designation of specific areas that would be leased, and the exclusion of others from leasing, has come to be referred to as the "classification" of

the Range, and it was upheld in Robert B. Atwood et al. v. Udall (30 FR 2d 748) as a legitimate exercise of the broad discretionary authority granted to the Secretary of the Interior by the Mineral Leasing Act of 1920 to lease only those lands that he sees fit to lease. (This case is discussed in the Kenai case study found in Chapter 4.)

Procedures for the designation of Federal acreage suitable for leasing have evolved significantly since the classification of the KNMR in 1958. Formal environmental review with broader agency and public participation has become an important element, as have ecological baseline and impact studies of the resources of the area proposed for leasing. This evolution is represented in the pre-lease tract selection process of the Federal government's OCS petroleum leasing program.

In anticipation of Secretarial or Congressional directives to lease refuge land in Alaska, the FWS should develop a formal set of policies and procedures for the selection of specific areas that are suitable for leasing (i.e., those lands that can be adequately protected from the effects of petroleum exploration and development by stipulations and mitigating measures). These formal procedures should explicitly define the roles of the BLM and other agencies while enhancing FWS's lead and initiative in the process. Existing regulations (43 CFR 3101.3) require that BLM agree to the ultimate designations. Therefore, FWS should work cooperatively with BLM from the outset. Especially important is the involvement of BLM in the design of baseline and impact studies. Participation by the Alaska Department of Fish and Game (ADFG) in this enterprise is also desirable. Although BLM and ADFG personnel may not actually collect and analyze data, senior biologists from these agencies should advise FWS on the priority of studies, research methodology, location, techniques, timing of data collection, and others.

FWS procedures for classification should follow the model of OCS tract selection, and as a minimum it should include the steps outlined below. Interagency agreements should formalize the procedures, including agency roles and timing, and sequence of events, from beginning to end. These procedures may require 2 to 4 years to implement from the time they are initiated by Secretarial directive, depending upon the quantity and quality of the existing data base for an area. Classification procedures should include the following:

1. FWS calls for resource assessments from other affected agencies; these would include petroleum resource evaluations and geophysical survey reports from USGS.

2. FWS conducts environmental assessment (EA) for any further geophysical survey work, including seismic surveys (under USGS supervision) considered necessary for adequate subsurface evaluation; BLM, USGS, and ADFG participate in preparation of EA and development of stipulations.

3. FWS, BLM, and ADFG identify and initiate appropriate ecological baseline and impact analysis studies for tract selection and for long-range exploration and development phases of petroleum activity.

4. FWS and BLM classify refuge lands for oil and gas development and determine tentative tract selections based on all available resource information, including USGS assessments of petroleum resource potential.

5. FWS takes lead in preparing EA on prospective leasing of tentative tracts or proceeds directly to preparing draft and final environmental impact statements.

6. FWS takes lead in preparing environmental stipulations for exploration operations (and development/production activities if applicable) on leased tracts, working primarily with BLM, ADFG, and USGS.

7. FWS assists BLM in preparing program decision option document, which would also include contributions from USGS and other agencies.

8. FWS and BLM determine final tract selections, with participation of USGS and others.

9. Secretary approves final tract selection and decision to lease.

FWS Interagency Relationships. Outside of National Wildlife Refuge System lands, FWS authority to protect fish and wildlife resources is ordinarily limited except to review federal actions affecting bodies of water or to protect endangered species and migratory birds. To strengthen fish and wildlife protection measures on other federal lands, therefore, FWS should develop explicit and detailed Memoranda of Understanding and other interagency agreements that would define FWS's roles and responsibilities in all phases of environmental regulation for development projects. Existing models for such agreements include the OCS and geothermal Memoranda of Understanding previously noted and the "Memorandum of Agreement between the Secretary of the Interior and the Secretary of the Army" of March 24, 1980. The latter document describes detailed procedures for a strong FWS role in reviewing Section 404 permits issued by the Corps of Engineers for the discharge of dredged or fill materials into navigable waters and wetlands. Adequate procedures also exist for FWS review of EPA National Pollutant Discharge Elimination System (NPDES) permits, Coast Guard permits for construction of bridges and causeways over navigable waters, and participation in Environmental Impact Statement (EIS) processes.

FWS should survey opportunities to develop, improve, and strengthen such agreements covering:

- o Review of other agencies' plans, regulations, and standards potentially affecting fish and wildlife resources, including migratory birds and endangered species;

- o Review of BLM material mining and right-of-way permits;

- o Participation in planning, coordination, and studies groups, such as the Executive Coordinating Committee and the Interagency Fish and Wildlife Task Force for the prospective Alaska natural gas pipeline;

- o Contributions to and review of environmental assessments prepared for permits or exploration and development operations;

- o Contributions to and review of stipulations and other forms of surface protection requirements;

- o Reviews of draft and final plans of operation and any further site-specific documents such as drilling site EA's and gravel mining plans;

- o Participation in pre-lease processes such as selection of tracts for leasing and preparation of program decision option documents; and

- o Participation in interagency field assessments and inspections from pre-exploration to termination phases.

At the Federal level, FWS's most significant interagency interests in the environmental regulation of petroleum activities are with BLM and USGS. FWS should give special consideration to developing a single, comprehensive agreement with these two agencies, covering all or most of the activities listed above. At the State level, FWS should consider development of a similarly comprehensive Memorandum of Understanding with the ADFG. Such a Memorandum would describe FWS's advisory relationship to ADFG, which directly participates in State-regulated petroleum activities. The agreement might give special attention to cooperative procedures for situations when FWS and ADFG resource management authorities appear to overlap or where their jurisdictions adjoin or otherwise interact.

Memoranda of Understanding and cooperative procedures should, of course, be tailored to the purposes and needs of the specific agencies concerned. However, where relatively complex and sensitive matters of agency jurisdiction and responsibility are involved, it will be in the interest of all affected agencies to make such documents as clear, explicit, and precise as possible to minimize or avoid misunderstandings and inefficiencies in their implementation. Thus, an adequate Memorandum of Understanding concerning interagency environmental protection activities related to petroleum and other development projects should include:

- o A statement of scope and purposes, with specific objectives;
- o Citation of applicable statutory and other authorities;
- o Detailed agency responsibilities for each phase or aspect of activity;
- o Schedules for all submissions and meetings;
- o Detailed procedures for decisionmaking;
- o Time constraints applicable at each step of interdependent agency activity, such as review and comment periods;
- o A referral process to higher executive levels for resolving disagreements;
- o Designation of responsible coordinating and implementing offices; and
- o Procedures for amending or rescinding the Memoranda of Understanding.

Such Memoranda should discuss arrangements for financing and conducting of relevant ecological and impact studies, developing and implementing stipulations, classifying and selecting tracts for leasing, reviewing plans of operation and similar documents, conducting field inspections, and communicating with operators in the field.

EIS Process. Participation as a cooperating agency in an environmental impact statement process led by another agency should not divert FWS from other important parts of the decisionmaking process, such as those listed above. Precisely because the EIS can easily be isolated from the process of development project planning and decisionmaking, the National Environmental Policy Act (NEPA) regulations now (since 1978) indicate that agencies shall "integrate the requirements of NEPA with other planning and environmental review procedures" (40 CFR 1500.2) and "adopt procedures to ensure that decisions are made in accordance with the policies and purposes of the Act" (40 CFR 1505.1). To the extent that current NEPA regulations guide agency practice, and the EIS influences agency decisions, it is obviously in FWS's interest to participate actively as a cooperating agency. (FWS's role as lead EIS agency does not require special comment.)

Selected provisions of NEPA regulations bearing on FWS's cooperating role are worth noting:

1. FWS can participate as a cooperating agency based either on its jurisdiction by law or its "special expertise" (1501.6), which means "statutory responsibility, agency mission, or related progam experience" (1508.26).

2. The lead agency must publish in the Federal Register a "notice of intent" that an EIS will be prepared and provide relevant information about the proposed process (1508.2); if not initially asked by the lead agency, FWS may request that it be designated a cooperating agency (1501.6).

3. A cooperating agency shall participate in the "scoping process," which determines the "range of actions, alternatives, and impacts to be considered" in an EIS (1501.7, 1508.25).

4. The NEPA-EIS process includes preparation of an environmental assessment, a mini-EIS that precedes and helps determine the need for a full environmental impact statement, and a lead agency would usually seek to consult with prospective cooperating agencies in preparing an EA (1508.9).[1]

5. NEPA regulations establish procedures for "referring to [CEQ] federal interagency disagreements concerning proposed major federal actions that might cause unsatisfactory environmental effects" (1504.1-3).

FWS might also view the EIS process as an opportunity to systematically assess the adequacy of project, ecological, and impact information and to determine priorities for and to advocate study projects.

Research and Information. The Fish and Wildlife Service's superior information and expertise on fish and wildlife populations and habitats, effects of disturbances, and mitigating measures probably do more to establish its authority in interagency environmental management than do its formal statutory mandates. This is epecially true where FWS statutes may be too general, ambiguous, or narrow, where other agencies can claim competing or preemptive statutory or administrative authority, and where FWS status as a cooperating or advisory agency simply places it in a distinctly subordinate role.

When FWS professionals can demonstrate the presence of critical habitat or fish and wildlife populations, their sensitivities to potential disturbances, and likely impacts and consequences, they are in a very strong position to influence decisions and to require effective mitigation. It is, therefore, in FWS's interest to make the most of its status as the preeminent expert in fish and wildlife matters on Alaska's Federal lands. Ecological baseline and impact studies should consistently support FWS participation and influence in interagency environmental surveillance programs.

[1]The NPRA exploration program EA's are, in contrast, used for site-specific analyses and prescriptions, and they are prepared subsequent not only to the one EIS (1977) but also to annual plans of operation (Chapter 4 above).

At the earliest possible stages of planning for prospective development activity (e.g., new legislative proposals, a permit application, a notice of intent to prepare an EIS, an EIS "scoping" meeting), FWS should identify the likely range of fish and wildlife issues and information needs, determine what is known and not known, and establish tentative priorities for filling information gaps. As suggested above, the EIS process could be the occasion for planning a comprehensive information program specifically responsive to the proposed development project.

Training. FWS professionals engaged in pre- and post-lease planning, monitoring, and study programs require expertise in industrial processes, practices, and technology (see Chapter 6). FWS should therefore consider developing an in-service training program in petroleum industry exploration, development, and production activities. Such a program should include a minimum of two major elements:

- Tours of the KNMR, the NPRA, and other areas of current petroleum activity in Alaska. FWS has accumulated much valuable knowledge and experience in the KNMR, and it could draw profitably on the expertise of the managers and staff officials who have monitored KNMR petroleum developments during the past two decades.

- Short courses and workshops covering all phases of petroleum activity from pre-lease exploration through termination. While providing broad exposure to industry technology and processes, such programs could focus on those elements of petroleum activity to which fish and wildlife resources may be particularly sensitive, such as water-related construction and off-road transportation.

Although FWS may want to contract for petroleum engineering expertise to assist in designing and conducting such training activities, it should not attempt to hire petroleum engineers and allied industrial professionals as permanent members of an in-house staff for pre- and post-lease planning and environmental surveillance. It simply is not likely that such persons would have the necessary credibility, whatever their technical qualifications, to function effectively with their professional counterparts in industry and in other agencies. FWS should instead continue to rely primarily on USGS for required technical support.

FWS Organization. Experience with large-scale development projects such as TAPS has shown that planning and surveillance activities require the attention of a full-time, specialized staff. The FWS should consider establishing a permanent Environmental Surveillance staff in the Alaska Regional Office. This staff would provide leadership, coordination, technical support, and continuity to all FWS activities involving the pre-lease planning for and post-lease surveillance of major development projects in Alaska. The staff could help assure that FWS's cumulative stock of knowledge and experience in development impact activities is consolidated and extended to meet the management requirements of future onshore petroleum, oil and gas pipeline, OCS, hydroelectric, and other large-scale projects potentially affecting Alaska's fish and wildlife resources.

Such a staff could be part of the existing Division of Ecological Services under the Land and Water Resources Development Planning Program, or it could be located directly under the Assistant Area Director for Environment. As part of the Division of Ecological Services, the surveillance staff could build directly upon that Division's existing technical assistance and reporting, permit review, and interagency planning and advisory functions related to development projects affecting fish and wildlife resources. Alternatively, as part of or directly under the Office of the Assistant Area Director, the staff might have the prominence and visibility that would help strengthen its role in interagency relations, and it could be organized to draw direct support not only from the Land and Water Resources Development Planning Program, but also from the Biological Services Program and the Environmental Contaminants Evaluation Program, which are also under the Office of the Assistant Area Director for Environment.

In either situation, the surveillance staff would focus on problems of anticipating and mitigating impacts of development projects on fish and wildlife resources. Its functions could cover the full range of environmental surveillance operations involved in all phases of development project planning, construction, operation, and termination. The staff would establish, in one place, integrated support responsibilities for interrelated technical, organizational, and, of particular significance, procedural aspects of environmental surveillance. It would serve as FWS's in-house expert on development impact planning, environmental surveillance organization and processes, and impact mitigation.

The surveillance staff would coordinate, provide support for, and directly participate in several areas of environmental surveillance program planning and development including:

- FWS involvement in interagency environmental planning for development projects, such as the Alaska natural gas pipeline;
- Preparation or review of environmental assessments, EIS's, plans of operation, and similar documents;
- Review and comment on permit applications referred by other agencies;
- Development of Memoranda of Understanding, cooperative procedures, and other interagency agreements concerning environmental protection management and surveillance; and
- Design and conduct of FWS training programs on industry technology and practices, project monitoring, and impact mitigation.

Some of the important tasks of the surveillance staff would depend on, and change with, different development projects and problems over time. Although the staff would provide continuity, it may also require varying combinations of experience and expertise with individuals being detailed to work with the staff for specific projects and time periods. In effect,

an Environmental Surveillance staff would be a positive step toward further institutionalizing the FWS interests and concerns that gave rise to this study project.

CHAPTER 6

THE ROLE OF STIPULATIONS IN ENVIRONMENTAL MANAGEMENT

The purposes of this chapter are to evaluate existing stipulations for fish and wildlife protection for their applicability to FWS needs, and then to develop a set of stipulations that can be used by FWS, with minor modifications, for future planning, leasing, and monitoring of petroleum development in Alaska. The stipulations evaluated have been developed for the KNMR, NPRA, TAPS, and the proposed trans-Alaska natural gas pipeline. This chapter will include stipulations that are applicable to exploration, development, and operational phases of oil and gas projects.

Before discussing stipulations, it is necessary to clarify the relationship between regulations, permits, stipulations, conditions, specifications, notices to proceed, and stop-work orders. Regulations are developed by Federal agencies as required by laws enacted by Congress. For example, Section 404 of the Clean Water Act requires a permit from the Corps of Engineers to place fill in navigable waters of the United States. The Corps of Engineers has developed extensive regulations describing how the permit is applied for and granted, the circumstances under which it is needed, and how infractions will be handled.

A permit may be required by either legislation or by regulation. Certain activities (such as filling wetlands) are undesirable in some situations and allowable in others. Therefore, to exercise some control over persons wishing to engage in activities that may be detrimental, the agency will require that a permit be obtained before the activity commences. This allows the agency to examine the circumstances of the proposed project and if necessary to attach conditions to the permit.

A typical permit constraint is that the permittee abide by specific stipulations. For example, in the case of the TAPS, stipulations stated that allowances must be made for free passage of big game animals. The government then required that the permittee develop "specifications" to fulfill the stipulations. The big game passage stipulation was translated into the following specifications: Within zones of big game migration, elevated pipelines would provide at least 10 feet between top of the work pad and bottom of pipe for distances not less than 60 feet in length at intervals of one-half mile.

Stipulations are usually general statements of how an operation must be done. To handle the site-specific nature of many operations, notices to proceed (NTP's) were developed. The permittee, responsive to the stipulations and armed with adequate specifications, must also receive an NTP before proceeding with field operations. This allows the government to satisfy itself that the permittee's site-specific plans, designs, and timing are in accordance with the stipulations, and that all other applicable State, Federal, and local permits have been obtained by the permittee. The need for NTP's is specified by the stipulations.

If the permittee fails to abide by the stipulations or specifications, the government can issue "stop work orders." These are also required by the stipulations. Stop work orders can be issued for certain operations or for the entire project, the latter being a very serious matter, usually requiring approval of the Secretary of the Interior.

CHAPTER 7

INFORMATION NEEDS FOR NATURAL RESOURCE PROTECTION DURING PETROLEUM DEVELOPMENT

INTRODUCTION

Effective protection of fish and wildlife resources during each step in the petroleum development process requires that decisionmakers and resource managers have access to timely, accurate, and pertinent information. The entire process of resource management has become extraordinarily complex in recent years because of tortuous legal and administrative procedures, multi-agency responsibilities, increasing resource use conflicts, growing sophistication of mitigation measures, and the inherent complexity of ecological processes. It is, therefore, imperative that information management systems be carefully designed to help the decisionmaker keep pace with these changes and provide him with the specific background needed for responsible and informed decisions. Loosely structured, informal programs for accumulating data are no longer applicable to the resource management process.

Information gathering efforts are always limited by considerations of time and funding. Therefore, it is extremely important that the right kinds of information be compiled and collected in order to maximize the effectiveness of natural resource protection within a certain level of effort established by time or appropriations, or both. The theme of this chapter is that information management programs must be directed at informing the key decisions of the phase of petroleum development under consideration. It is, therefore, necessary that these decisions be clearly defined before designing the information program. Furthermore, the resource manager must be aware of the types of information that are, in fact, pertinent to a particular decision framework.

KEY DECISION POINTS AND INFORMATION REQUIREMENTS

Several important points need to be considered when reading the following sections and when making decisions regarding information requirements.

1. It is always desirable to acquire as complete a resource information base as conditions allow. An accurate, timely, well formulated, and complete description of biological resources and their responses to disturbance provides the basis for informed decisions regarding those resources.

2. Information acquisition is always limited by time and funds. Therefore, choices must be made about the information that has highest priority, and decisions made about the minimum level of information that allows an accurate and satisfactory estimation of environmental impacts of a given development activity.

3. The ultimate goal is to make resource management decisions that minimize impacts to fish and wildlife resources and habitats; therefore, emphasis should center on acquisition of information that will, in fact, aid the resource manager.

4. The detail of information available for a particular site may affect the resource management philosophy applied to the site. If the data base is minimal then it may be appropriate to apply a conservative management approach to protect against all possible impacts. A more complete data base may show that some protective measures are, in fact, unnecessary and thereby allow a more relaxed approach. This may result in economic benefits sufficient to compensate for the cost of acquiring the additional information. Additionally, a complete data base minimizes uncertainty and thereby minimizes costly last minute alterations in project plans. In other words, information costs are not strictly additive in relation to total development cost.

5. Information needed for decisions at any phase in the petroleum development process must be available at the right time. Study results received after decisions have been made cannot influence those decisions.

6. Information needs tend to become more specific and detailed as the decision process progresses from early to late phases. That is, information needs become more specific as the planning process evolves and as intrusive activities become more defined and localized. This increasing level of detail parallels, and is related to, the process of creating and revising stipulations and regulations.

7. A primary information need during all phases of development is that of ecologically sensitive or valuable areas, or both. An area may be sensitive or valuable for a variety of reasons:

    a. The area may contain habitat that is essential to the well being of a particular species population (e.g., nesting, spawning, feeding, migrating, or overwintering areas).

b. The area may perform an essential ecological function such as transport of nutrients between ecosystems.

c. The area may contain or be comprised of rare, endangered, or unusual species.

d. The area may be particularly vulnerable to man-caused disturbance. For example, some species of plants are more sensitive than others to oil spills.

e. The area may be particularly difficult to rehabilitate after disturbance.

f. The above factors may result in a high composite sensitivity for a particular area.

8. Time and money spent on information collection and dissemination should reflect the potential for and severity of impacts of a proposed activity.

OVERVIEW OF INFORMATION NEEDS AND PRIORITIES

Information needs relative to the total petroleum development process are represented by a continuum ranging from general to specific as the process evolves from planning to site-specific activity and by a difference in emphasis depending on the needs of decisionmakers in each phase.

The primary goal of the resource manager during the pre-lease long-range planning and lease decision phases is to make informed decisions about possible future land uses. Therefore, information needs are oriented toward determining relative natural resource values and resource sensitivities. The primary goal of the resource manager during the site-specific activity phases is the avoidance, mitigation, and documentation of actual impacts resulting from a specific disturbance. Information needs during these phases, therefore, are more problem-specific than during the planning phases.

Table 5 summarizes information that is presently most useful to oil and gas development in Alaska. Two kinds of information are included: 1) inventory of relevant components of the existing environment, and 2) special studies or analyses of specific aspects of impact mitigation.

Table 6 summarizes information needs during the key phases of the petroleum development process.

Table 5

Hierarchical Listing Of Resource Information Priorities For Fish And Wildlife Protection
During Onshore Petroleum Development In Alaska

1. HABITAT MAPPING AND EVALUATION

Wetland Delineation and Classification
- Classification according to plant community types
- Classification according to soil moisture/water depth

Terrestrial Habitat Delineation and Classification
- Classification according to plant community types
- Classification according to land form

Evaluation According to Combined Ecological Values
- Value to important species (see below)
- Value in relation to ecological processes
  - Productivity
  - Energy and nutrient flow

2. EXAMINATION OF IMPORTANT SPECIES IN THE DEVELOPMENT AREA

Legally important Species (e.g. threatened, endangered or protected species)
Ecologically Important Species (as per site analysis)
Economically Important Species
Politically Sensitive Species, (e.g., wolf)

3. DELINEATION OF CRITICAL AND SENSITIVE HABITATS

Areas Essential to Specific Life History Stages of Important Species
- Nesting, calving, lambing, spawning areas
- Migratory corridors
- Fish rearing areas

Denning

Areas of Permanent or Seasonal Species congregation
- Fish overwintering areas
- Big game seasonal use areas
- Waterfowl staging and molting areas
- Mineral licks

Special Feeding Areas

Areas Essential to the Continuation of Important Ecological Processes
- Wetland contribution to energy and nutrient flow
- Areas of high primary productivity

Areas Particularly Sensitive to Potential Impacts

4. DELINEATION OF SENSITIVE TIME PERIODS

Migration Times (on an area- or stream-specific basis)

Timing of Reproductive Activity For Important Species

Timing of Development of Eggs and Young

Timing of Seasonal Species Congregations

5. EXAMINATION OF BIOLOGICAL PROCESSES OR SPECIES CHARACTERISTICS IMPORTANT TO TECHNICAL DESIGN CRITERIA

Fish Swimming Ability and Behavior Relative to Drainage Structures

Response of Animals to Noise and Activity

Response of Animals to Physical Obstruction

Response of Animals to Plant Species Used in Revegetation

6. EXAMINATION OF POTENTIAL OR ACTUAL PROJECT-SPECIFIC IMPACTS

Examples: Reaction of Caribou to Elevated Pipelines (TAPS); Toxicity of Drilling Muds (OCS); Effect of buried chilled gas pipeline on ground vegetation (ANGTS)

7. EXAMINATION OF PHYSICAL PARAMETERS IMPORTANT TO FISH AND WILDLIFE PROTECTION

Stream Hydrology

Soil Characteristics Relative to Thermal and Hydraulic Erosion Potential

8. IDENTIFICATION AND EXAMINATION OF SPECIAL PROBLEMS

Human/Carnivore Interactions

Effects of Hunting and Fishing

Table 6

Summary of Information Needs Required for Natural Resource Protection Decisions During the Various Phases of the Petroleum Development Process

Information Category	Pre-Lease Long-Range Planning Phase	Pre-Lease Exploration Phase	Lease Decision Phase	Post-Lease Site Specific Activity Phases (Exploration, Development, Production)	Termination Phase	Follow-up Phase
ECOLOGICAL BASELINE						
Habitat Description	Delineation of major habitat types, relative habitat values and biological sensitivities of habitats within region	Description of habitat types and values transected by seismic corridors	Delineation of habitat types; identification of critical, sensitive, and high value areas	Detailed description of site area, or, if a large scale project, emphasis on sensitive areas	Description of pre-development habitat	Description of pre-development habitat
Species Inventory	Distribution and abundance of important species (ecologically dominant, endangered, economically important)	Species distribution and abundance as related to seismic corridor location	Distribution and abundance of major species - expand on detail from long-range planning phase	Distribution of major species as related to potential project impacts	Existing data base adequate	Pre-development species abundance and distribution
Species Ecology and Behavior	Basic life history of important species with emphasis on limiting factors and sensitivity to human disturbances	Aspects relating to sensitivity to seismic activities	Expand on detail from long-range planning phase - emphasis on critical habitat requirements	Aspects relating to design criteria, sensitive time periods, critical habitats, other project-specific problems	Existing data base adequate	Pre-development wildlife behavior and life history information
Physical Data	Regional data: climate, landform, hydrology, water quality, soils	Data as applicable to project needs	Expand on detail from long-range planning phase	Data as needed for project-specific fish and wildlife protection	Existing data base adequate	Pre-development physical data as appropriate
Ecological Processes	General description of important functions and processes for each major habitat type		General pathways of energy and nutrient flow; important energy transfer steps	Pathways of energy and nutrient flow as related to potential project impacts	Existing data base adequate	Pre-development energy and nutrient data
Ecosystem Modelling				Qualitative or quantitative model if practical and appropriate	Existing data base adequate	Pre-development ecologic data
IMPACT ANALYSIS						
General	Synthesis of impact information pertaining to oil and gas development	Synsthesis of impact information pertaining to seismic exploration	Impacts to unique habitats in lease area	Impacts of activities common to the proposed project	Beneficial and adverse impacts of restoration procedures	General effectiveness of mitigation procedures; accuracy of impact predictions
Project-specific				Impacts of unique project activities	Project-specific restoration techniques	Actual impacts on important species or habitats
INDUSTRY DEVELOPMENT INFORMATION						
Technical Background	Overview of oil and gas potential; basic knowledge of development activities and construction methods	Exploration techniques	Oil and gas potentials by area; knowledge of the petroleum development process including possible scenarios; special environmental stipulations/requirements	Exploration, development, production and mitigation techniques	Habitat restoration techniques	General knowledge of previous activities
Project-Specific		Detailed work plans with activity locations; timing and duration of activities		Detailed project plans including locations, construction methods, timing, and mitigation techniques	Detailed termination plan including restoration plans and techniques	Knowledge of previous activities including procedures actually employed if different from planned procedures