

**SOCIAL DISRUPTION  
AND THE VALDEZ OIL SPILL:  
ALASKAN NATIVES  
IN A NATURAL RESOURCE COMMUNITY**

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CHRISTOPHER L. DYER  
University of South Alabama

DUANE A. GILL  
Mississippi State University

J. STEVEN PICOU  
University of South Alabama

*This study presents a conceptual model for examining the social impacts of the Valdez oil spill on natural resource-dependent communities. Data on social and subsistence disruption experienced by Alaskan natives are analyzed for two time periods: 1989 and 1990. The results reveal substantial uncertainty and disruption, with indications of changing patterns for long-term social impacts. The study concludes with recommendations for restoration and recovery suggested from the results of our data analysis and the natural resource community model.*

The press of my foot to the earth springs a hundred affections,  
They scorn the best I can do to relate them.  
Walt Whitman

Understanding the relationship between the human experience and the environment is a challenge. The study of the relationship between individuals, their units of social organiza-

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tion, and the environment also poses a complex area for social science research given the interdisciplinary nature of this endeavor. This is partly due to the inherent complexity of human communities and the difficulty in precisely defining and measuring what social scientists conceptualize as "community" (Hillery 1955).

This research presents a conceptual model for studying natural resource-dependent communities. The relationship between natural resources and their dependent human populations has been documented (Chagnon and Hames 1979; Klee 1980; Krebs and Davies 1978; McCay 1981; Stocks 1987). However, a community model unifying patterns of natural resource utilization and social organization has not been proposed. This conceptual model is used to evaluate selected social impacts of the Valdez oil spill on a small fishing community in Alaska.

Definitions of community have generally excluded an ecologically focused conceptualization (Hillery 1982). The interaction between humans and their environment has been restricted primarily to the study of social organization (Hannan and Freeman 1977; Winter 1964). Ecology, per se, is used as a "source of models and metaphors whose only test is in their utility in the study of social organization (Siegel 1984, p. 23).

A social organization approach to human ecology that deals specifically with disasters has been identified. Harshbarger (1976) devised an "ecological" model for assessing individual and group needs during disaster intervention. However, there is no human-environment interaction pattern integrated into this model. Harshbarger (1976) suggested a "social organization" of disaster intervention based on formal and informal community systems.

We propose an alternative framework called the natural resource community (NRC) model. We define an NRC as a population of individuals living within a bounded area whose primary cultural existence is based on the utilization of renewable natural resources. This concept is not restricted to subsistence hunting and gathering but includes agriculture-based villages (Mead 1979) and coastal communities (McGoodwin 1990). In an NRC, traditional subsistence activities represent the most persistent cultural activity. Many coastal fishing and subsistence communities in Alaska can be classified as NRCs.

The viability of NRCs is threatened when there is a disrupt-

tion of the natural resource base. This situation exists in an acute form following a technological disaster that contaminates the resource base. The 20th century has been characterized by the continuing occurrence of technological disasters. Disasters at Bhopal (1986), Chernobyl (1986), Three Mile Island (1979), and Buffalo Creek (1972) were unique because some form of technological malfunction, not nature, was defined as the primary cause. The Valdez oil spill was a technological disaster that threatened the natural resource-based coastal fishing communities in Prince William Sound, Alaska. The present study provides initial data on patterns of disruption experienced by Alaskan natives in a natural resource community.<sup>1</sup>

### THE NATURAL RESOURCE COMMUNITY

As noted, the NRC is uniquely characterized by a traditional dependence on the utilization of renewable natural resources. The relationship between community cultural activities and resource utilization provides a dynamic pattern that links human behavior to the ecosystem. This relationship is conceptualized in Figure 1 in terms of a seasonal anticipatory utilization cycle (AUC).

The NRC model depicts the interaction between cultural and biological cycles. The cultural cycle is divided into four phases: (1) preparation; (2) harvesting; (3) utilization; and (4) anticipation (Figure 1). The biological cycle represents seasonal resource growth and development. The most important natural resource in Prince William Sound, both for commercial and subsistence purposes, is fisheries. The preparation phase includes all activities involving the readying of gear, identification of target areas, crew selection, and, if appropriate, training. The harvesting phase is the actual event of resource collection and preparation. The utilization phase involves all activities associated with the conversion of the catch to usable resources. The final phase, anticipation, is an interim "resting" period in which assessments of the previous harvest season and predictions about the upcoming season guide decisions for future behavior in the fishery.

<sup>1</sup>For an analysis of the social impacts of toxic waste contamination in other community settings, see Edelstein (1988).

Subsistence-based populations worldwide are linked to such natural cycles. As Drueker noted for native Americans of the Northwest Coast:

Looking at a generalized picture of aboriginal culture, then one finds a close relationship between resources and population distribution and community organization, the territory determining the character and limits of the community. Within the framework of the tribe and its territories, a rhythm of seasonal activity was set in motion. (1955, p. 272)

An NRC may be further characterized as being "open" or "closed."<sup>2</sup> An example of a closed NRC is the Alaskan native village of Tatitlek in Prince William Sound (Figure 2). Closed NRCs are geographically and culturally isolated from outside influence and emphasize the historical legitimacy of user rights to resources. An important aspect of identification as a legiti-

<sup>2</sup>Wolf (1957) originally conceptualized "open" and "closed" peasant communities as the degree of capitalization (open) versus dedication to a socioeconomic corporate structure based on cost sharing (closed).

### Anticipatory Utilization Cycle

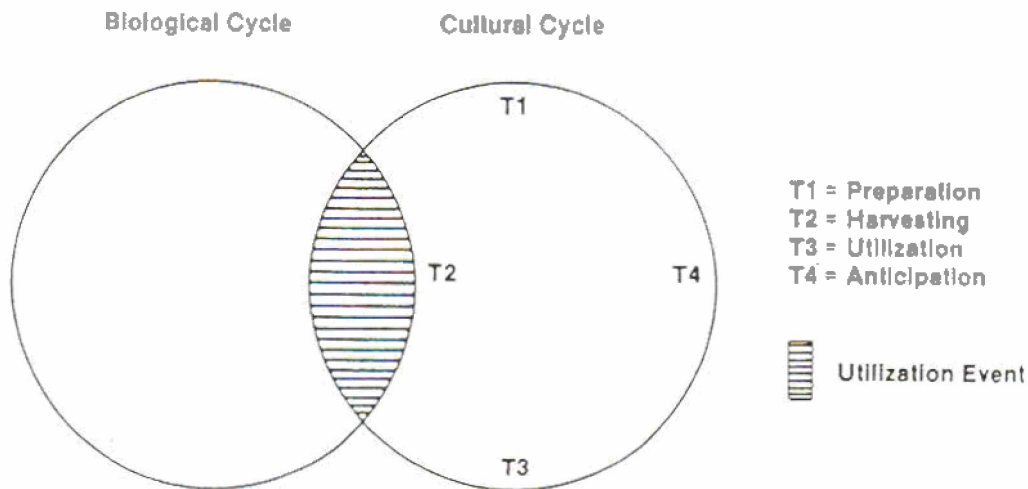


FIGURE 1. The cyclic relationship between cultural and natural events in a natural resource community.

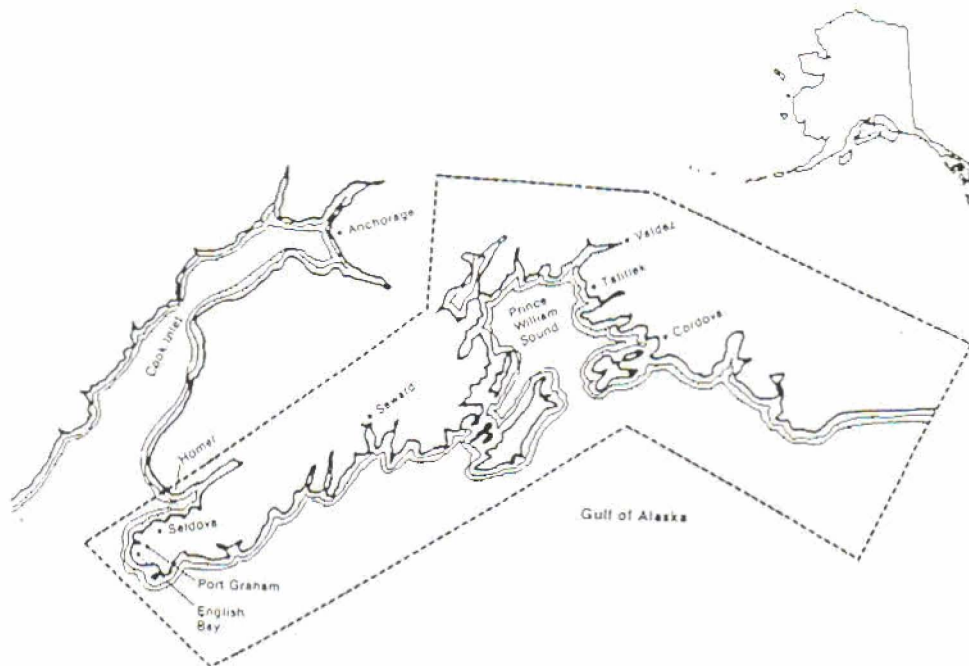


FIGURE 2. Map of the study site.

mate user of any resource in a closed NRC can also be kinship. Kinship ties traditionally determine legitimacy of resource access. This is most common in native villages (Ellanna and Sherrod 1984; Fall 1990; Stanek 1985). Territoriality is a product of resource access. For example, territorial lobster fiefs of Maine can be viewed as constituting a closed NRC, where legitimacy of resource use is based on established social networks in the community (Acheson 1988). Residency is not the critical factor in NRCs such as native villages. Rather, it is kinship and exchange ties that structure and maintain this social system (Spencer 1953).

In an open NRC, it is easier to gain access to the fisheries. There is less isolation, and the community residents have greater potential for out-migration. Residency may only be seasonal, and this seasonality is related to the cyclic utilization of renewable natural resources. Establishing relationships with buyers and sellers does not necessarily require being linked to long-established social or kinship networks. For example, fishing permits in the open NRC of Cordova were once owned by many Alaskan natives. Presently, these permits are increasingly

being purchased by nonnative outsiders as competition for fishery resources increases. There is also a weaker claim to territoriality in an open NRC because resource access can be easily transferred through cash purchases.

The traditions associated with natural resource utilization shape the social and economic relationships of NRCs. Native villages are particularly resource-dependent. A subsistence lifestyle practiced by ancestors defines the contemporary cultural identity of such communities. Social cooperative networks, family activities, religion, and other activities are directed toward fishing, hunting, gathering, and sharing of natural resources (Berger 1985; Case 1989). The actual or perceived loss of resources can disrupt these socially valued activities. The subsequent economic, social, and psychological consequences of such loss can be severe and prolonged. In this regard, renewable natural resources represent "natural capital" (Olson 1980; Wolfe and Walker 1987). Such capital is manifest as social, nutritional, economic, and cultural products (Marks 1976, 1977). This includes "psychic income" (Neale 1971), which is derived in an NRC from the socioeconomic buffer provided by renewable natural resources. For example, when other resource options fail (e.g., cash income), natural resource utilization provides a hedge on uncertainty (Johnson 1971; Lonner 1980).

In nonnative NRCs, the reliance on natural fishery resources has a strong occupational basis. The commercial fishing industry includes not only fishermen but also the many social and economic support relationships that compose it. For example, canneries, banks, repair shops, hatcheries, and numerous other businesses are to some degree dependent on the local fishing industry.

#### THE RESEARCH SETTING: CORDOVA AS AN NRC

Cordova is a small fishing community (population: 2,150) located in the southwestern corner of Prince William Sound (see Figure 2). The Cordova economy is dominated by fishing and is heavily dependent on all forms of marine resources. Marine resources represent a last "public domain" for community residents because the public, both national and international, has until recently had relatively open rights and access

to the environmental resources (Magnuson Fishery and Conservation Act of 1976). Commercial fisheries in Prince William Sound began with salmon and herring and expanded to include razor clams, halibut, crab, shrimp, and, most recently, rockfish and sablefish (Stratton 1989).

Besides commercial fishing, subsistence is an important component of resource utilization. Resources such as berries, marine invertebrates, vegetation, and wild game are harvested and shared. Stratton (1989) reported that a mean of 402.7 pounds of resources were harvested per household according to a 1985 survey of Cordova households. Salmon were found to be 39% of the harvest (156 pounds per household).

Resource sharing is a way of maintaining social networks in an NRC and an important tradition in Cordova (Table 1). For example, Stanek (1985) showed how a single harbor seal was distributed within an extended family network of eight households with 25 people. Because the object of sharing is a natural resource, the importance of natural resources to community well-being is emphasized in this manner. Social interaction patterns are characterized by exchanges of resources throughout the year.

Sharing and exchange strengthen social relationships and foster future cooperation in NRCs. Stratton's (1989) survey of Cordova households found that 95.6% reported receiving resources, and 79.1% reported giving resources to other households (see Table 1). Cordova had a high level of resource sharing; 91.3% reported receiving resources from other Cordova households. A majority of Cordova households (53.9%) sent resources out of Alaska to other places in the United States, most likely to extended family members (Stratton 1989). These data clearly define social interaction and resource utilization patterns characteristic of an NRC.

The Alaskan native population in Cordova is highly integrated with the larger Cordova community (i.e., a "village within a town"; Lonner 1980). Historically, the community of Cordova can be traced to four Eyak Indian villages. Early influence by Russian fur traders led to exploitation and decimation of Eyak populations. At the time this research was initiated, there were only two living speakers of the Eyak language. The village of Eyak does not exist as a distinct locale. It exists as the Eyak Village Council and the Eyak Corporation under the

**TABLE 1.**  
Communities and Number of Households Involved  
in Resource Distribution for Cordova

Community	Received resources from households (%)	Gave resources to households (%)
Anchorage	6 (2.9)	42 (20.4)
Cordova	188 (91.3)	133 (64.6)
Other Prince William Sound areas	16 (7.8)	13 (6.3)
Other Alaska areas	25 (12.1)	18 (8.7)
Outside Alaska	7 (3.4)	111 (53.9)
Outside United States	0 (0.0)	4 (1.9)
Unknown	4 (1.9)	7 (3.4)
Total <sup>a</sup>	197 <sup>b</sup> (95.6)	163 <sup>c</sup> (79.1)

<sup>a</sup>Respondents reported up to four areas from which or with which they shared resources.

<sup>b</sup>Six households mentioned receiving resources but did not identify which ones.

<sup>c</sup>Three households reported giving away resources that were not identified.

Source: Stratton, Lee (1989). Used with permission.

Alaska Natives Claims Act. The village is primarily a political and service organization. Native Alaskans who identify themselves with the village of Eyak live throughout the Cordova community.

The 1980 census reported that 15.2% of Cordova's population had native Alaskan ancestry. In Stratton's (1989) survey, 18% of the people in the 206 surveyed households reported that they were native Alaskan: a combination of Eyak, Chugach Eskimo (locally referred to as Aleut), and other Native Alaskans who moved into the area.

The case can be made that the active participation of many nonnative households in natural resource harvesting demonstrates the process of cultural assimilation of nonnatives into a native worldview. Alaskan native residents of Cordova have also culturally assimilated themselves into the local cash economy. Thus, assimilation has occurred between both groups, resulting in a mixed economy.

Langdon (1984, p. 5) commented that "subsistence is now integrated with cash economy in the lives of all Alaskan Natives." According to Berger,

Subsistence can require special skills and a complex understanding of the local environment that enables people to live directly from the land. It also involves cultural values and attitudes: mutual respect, sharing, resourcefulness, and an understanding that is both conscious and mystical of the intricate relationships that link humans, animals and the environment. To this array of activities and deeply embedded values, we attach the word *subsistence*, recognizing that no one word can adequately encompass all these related concepts. (Berger 1985, p. 5)

Because of the culturally integrative effects of subsistence behavior, we hypothesize that social disruption as a result of loss of subsistence resources should be substantial for a subsistence-based NRC.

### METHODOLOGY

On March 24, 1989, the supertanker *Exxon Valdez* ran aground on Bligh Reef in Prince William Sound, Alaska. The oil spill was the largest in the history of the United States; approximately 11 million gallons of Prudhoe Bay crude oil were released into the pristine waters of Prince William Sound. The immediate impacts on the local ecosystem were devastating. The death toll among water birds, sea otters, stellar sea lions, gray whales, orcas, and many varieties of fish was large.

No oil reached the shores of the Cordova community. However, critical herring and salmon fishing areas were impacted by the oil. Immediately following the spill, an armada of fishermen from Cordova volunteered to help contain the oil. Such action was not possible because of safety considerations. Nonetheless, Cordova residents were instrumental in booming hatchery areas in the sound and effectively helped to protect critical spawning areas.

This study is based on data collected over an 18-month period in Cordova, Alaska. The first data collection occurred 4½ months after the spill, and follow-up interviews were conducted approximately 18 months after. All data were gathered through personal interviews, which lasted from 1½ to 2½ hours. A snowball sampling technique was used to interview

Alaskan natives residing in Cordova.<sup>3</sup> This entailed identification of native respondents in identifiable social networks. A 9-day field trip to Cordova in August 1989 yielded 31 completed interviews. In the second phase of data collection (September 1990), 24 of the original 31 respondents were reinterviewed.

The community of Cordova, Alaska was selected for this study because of its history of economic dependence on commercial fishing and its cultural heritage of subsistence activities. The NRC model provides a description of actual cultural cycles and traditions of communities such as Cordova. The survey data provide an analysis of the impacts of the Valdez oil spill through the perceptions and behaviors of Alaskan natives living in an NRC. This research also uses ethnographic information collected by the researchers. This ethnographic data includes written responses to open-ended questions, tape-recorded interviews, conversations with local Alaskan native residents, and on-site field observations.

## RESULTS

### Perceptions and Behaviors of Disruption

Data collected during the two field visits represent the harvest period of the AUC (August–September). For both the 1989 and 1990 samples, the survey focused on perceptions of disruptions, uncertainty related to the loss of natural resources, stress, and social relationships.

Table 2 presents the personal reactions of the Alaskan native respondents at the time of the spill and their perceptions regarding future uncertainties. In general, the vast majority (90%) of the respondents were very upset by the spill event, and 64% manifested anxiety regarding continuing oil tanker traffic through Prince William Sound.

On the basis of responses from key informants, uncertainty in this case arises from fear of pollution and loss of natu-

<sup>3</sup>We acknowledge the limitations of generalizability that characterize "network" or "snowball" sampling strategies. However, the collection of valid cross-cultural data is typically not amenable to traditional survey sampling techniques. Because of this, methodological components of a more comprehensive study of Cordova included a random sample of residential dwellings in the community. For more details, see Picou, Gill, Dyer, and Curry (1990).

**TABLE 2.**  
**Personal Disruption and Uncertainty for Alaskan Natives**  
**in Cordova, Alaska**

Responses	Agree (%)	Disagree (%)	Neutral (%)
<b>August 1989 (N = 31)</b>			
At the time of the <i>Exxon Valdez</i> accident, I was very upset.	90	3	7
Today I am upset by the oil tankers running through Prince William Sound.	64	19	17
I feel that Exxon will fully compensate the people of my community.	10	61	29
We may never know the extent of the pollution caused by the <i>Exxon Valdez</i> spill.	77	10	13
		<b>Yes (%)</b>	<b>No (%)</b>
<b>September 1990 (N = 24)</b>			
In your opinion, is Prince William Sound clean of oil at this time?		5	95
The <i>Exxon Valdez</i> oil spill cleanup has been effective.		25	75
The oil spill will affect fishing in the near future.		75	25

ral resources. Seventy-seven percent agreed that the extent of pollution caused by the spill was unknown (Table 2). In addition, the majority (61%) of the respondents disagreed that the people in their community would be fully compensated. Compensation was defined by key informants to include the following: (1) restoration of natural resources to a prespill condition; (2) cash value for lost fishing resources (particularly for the 1989 season); and (3) removal of pollution created by the spill and its aftermath. These interpretations reflect a summation of responses from respondents who elaborated on the topic of compensation.

Uncertainty regarding physical pollution also characterized respondents in 1990. The vast majority (95%) of those interviewed felt that Prince William Sound was not clean of oil pollution caused by the oil spill. This perception was rein-

forced by responses that indicated that the oil spill cleanup had not been effective and that the oil spill will influence fishing activities in the near future. Health risk from the pollution is an ongoing concern among Prince William Sound residents (Restoration Planning Work Group 1990). The collective perception that natural resources are polluted may be sufficient to modify future behavior toward resource utilization.

Fall (1990) reported that fear of contamination of subsistence foods by oil from the Valdez spill was the most common reason cited for lower levels of subsistence harvest in Alaska native villages. Of 403 interviewed households in the impacted area, 33% reported that "fear of oil-contaminated foods reduced their harvests or uses" (Fall 1990, p. 10). Such perceptually based behavior modification can negatively disrupt cultural NRC cycles, leading to social dysfunction, deviance, and mental illness (Freudenburg and Jones 1991; Kroll-Smith and Couch 1989).

Perceptions of uncertainty toward resource use were prevalent throughout the communities impacted by the oil spill (McClintock 1989). Such uncertainty can be interpreted through the NRC model as well as with technological disaster effects (Freudenburg and Jones 1991). The "biophysical" damage of such disasters becomes relevant in an NRC. A community not as culturally dependent on renewable natural resources would not be as severely stressed by environmental pollution affecting such resources.

### Natural Resource Disruption

The control of natural resources is intrinsic to maintaining the cultural value of such resources. Concern over the disruption of natural resources was expressed by respondents interviewed in August 1989 (Table 3). A majority (58%) of those interviewed were not satisfied with their control over natural resources (see Table 3). For example, our interviews revealed a sense of loss at being denied access to the herring roe fishery because of the oil spill. Herring spawn close to areas near Bligh Reef and were immediately impacted by oil pollution. As one respondent explained, "I feel a real hunger for herring roe now that I can't have it. It makes me very sad to think I may never eat it again."

Alaskan natives expressed uncertainty regarding the suc-

**TABLE 3.**  
Natural Resource Disruption for Alaskan Natives  
in Cordova, Alaska<sup>a</sup>

In reference to how the spill has affected your natural resources . . .	Satisfied (%)	Not satisfied (%)	Neutral (%)
How do you feel about the amount of local influence you have over the condition of the land and water near your community?	35	58	7
How do you feel about the opportunities children have to continue their native traditions?	42	58	—
How do you feel about the opportunities children have to learn subsistence skills?	29	61	10
	Agree (%)	Disagree (%)	Neutral
Do you think subsistence activities such as fishing will ever be as successful as they were before the oil spill?	22	61	17
Do you think the oil spill will interfere with the teaching of subsistence skills to children?	61	29	10

<sup>a</sup>All data collected August 1989 (N = 31).

cess of future subsistence activities, and there was concern that the transmission of subsistence culture to offspring was threatened (see Table 3). These responses reflect changes in subsistence utilization in spill-impacted Alaska native villages from 1989 to 1990 (Fall 1990). In the year after the spill, 11 of the 15 communities in the oil impact area had the lowest harvest level of any year for which data are available (Fall 1990). In most communities (55%), the oil spill was blamed as the factor leading to decline in the use of subsistence resources for the year (Impact Assessment Inc. 1990).

The recovery of the communities should involve elimination of the biophysical pollution attributed to the spill. As Fall concluded, "until such signs disappear and people are able to place confidence in their abilities to attain, interpret and understand their environment, recovery from this disaster will likely remain incomplete" (1990, p. 24).

### Perception of Social Disruption

A comparison between data collected in 1989 and 1990 demonstrates that some continuing social impacts accompanying the disruption of cultural cycles can be identified. Potential long-term social impacts were identified from perceptions of changes in family, future plans, work, and community (Table 4).

The disruption of family relations for the 1989 sample was apparent; 58% of the respondents reported disruptive changes in family relationships. Key informants indicated that disruption arose from a breakdown of normal family routines associated with commercial fishing and subsistence activities. This form of disruption, however, significantly declined over the 1989 to 1990 year; one fourth of the 1990 respondents reported disruptions in their family relations. A majority (52%) of the 1989 sample indicated that the spill caused them to change their future plans. In August 1990, however, one third reported that the spill was impacting future plans—a significant decline

**TABLE 4.**  
Perceptions of Social Disruption from the Valdez Oil Spill  
for Alaskan Natives in Cordova, Alaska, 1989–1990

As a result of the spill . . .	Year	Response		N
		Agree	Neutral or disagree	
I have noticed changes in the way my family gets along together.	1989	58%	42%	31
	1990	25% <sup>a</sup>	75%	24
I have made changes in my plans for the future.	1989	52%	48%	31
	1990	33% <sup>b</sup>	67%	24
Things have changed for me at work.	1989	23% <sup>c</sup>	77%	31
	1990	50%	50%	24
The community of Cordova has changed.	1989	3% <sup>d</sup>	97%	31
	1990	75%	25%	24

Note. Fisher's exact probability provides a statistical analysis of the probability that the change from 1989 to 1990 was random or due to chance (see Blalock 1960).

<sup>a</sup>Fisher's exact probability = .014.

<sup>b</sup>Fisher's exact probability = .139.

<sup>c</sup>Fisher's exact probability = .033.

<sup>d</sup>Fisher's exact probability = .000.

from 1989. These patterns suggest a reduction of these types of disruption over time.

The spill created changes in the workplace, and work-related disruption was found to increase over time (Table 4). One fourth of the 1989 sample reported disruption at work. This increased to 50% in the 1990 sample. One major change noted by key informants resulted from crew changes in fishing. One consequence of the spill cleanup was that many crew members abandoned their jobs on fishing vessels to work on the spill. Others abandoned their jobs in town to work on the spill and did not return to their previous jobs the following season.

The most notable change reported by Alaskan natives concerned overall changes in the community of Cordova. In August 1989, almost no one (3%) perceived that the community had changed as a result of the spill. By August 1990, however, 75% of the respondents reported that the community had changed as a result.

This long-term disruption can be interpreted in terms of "secondary disaster effects," which have disrupted traditional networks of cooperative social relationships. These networks constitute the social structure of the community and are maintained through traditional patterns of resource utilization. Key informants stated that there had been significant disruption of sharing of subsistence resources. This trend was accounted for by the unavailability of resources as a result of real or perceived oil pollution. Also recipients of natural (subsistence) foods were experiencing decreased social contact or socializing with people from whom they had traditionally received foods. As one elderly key informant noted about a previous donor, "He doesn't bring me my smoked fish anymore. That money he got (from the oil spill cleanup) has turned him into a stranger."

Reports from other impacted communities reveal similar patterns of disruption of social networks and sharing (Impact Assessment Inc. 1990, p. 50). Social network and communal disruption caused by the oil spill are as real as physical pollution and environmental disruption. Because of the intricate nature-culture relationship in NRCs, long-term social effects may be just as persistent as direct physical pollution.

## DISCUSSION

This research has presented the concept of the NRC and empirically evaluated selected social impacts of the Valdez oil spill. The general hypothesis proposed here has been supported by our analyses. Alaskan natives in Cordova have experienced social disruption in terms of "uncertainty" regarding the degree of contamination and the ability to fully restore damaged natural resources. There is a concern and fear expressed in the inability to participate in and continue subsistence activities. Although personal and family disruption associated with the spill seems to be diminishing over time, perceptions of community conflict and work-related changes characterized the respondents in 1990. These results provide descriptive information on both short-term and long-term negative social impacts of the Valdez oil spill.

The social impacts that result from all types of technological disasters can disrupt the social order, generate collective stress and conflict, and create uncertainty (Freudenburg and Jones 1991; Gill and Picou 1989, 1991; Kroll-Smith and Couch 1989; Omohundro 1982). This pattern seems to characterize Alaskan natives in Cordova for perceptions of long-term occupational and community disruption. In this case, the impacts of technological disasters may be more severe than that of natural disasters in terms of prolonged social impacts that could characterize NRCs.

Ambiguity of biophysical damage should be most intense when industrial technology and technological cultural intrusion or "cultural pollution" is greatest (Freudenburg and Jones 1991). The oil spill cleanup also contributed a considerable degree of "cultural pollution." Examples include intrusion of oil spill workers, lawyers, state and federal personnel, as well as the introduction of nontraditional foods and plastics in native villages. This can be considered "pollution" in an NRC in the sense that it is not a normative product of traditional life-styles. Instead, it is imposed externally as part of a technologically sophisticated normative system, which is typical of the urban environments of most American cities. It is outside normative nature-culture cycles of natural resource utilization and, as such, is culturally ambiguous.

A technological disaster in the environment of an NRC is

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also ambiguous in the sense that it is not readily visible. Alaskan natives in impacted villages of Prince William Sound have expressed fear and anxiety over eating polluted fish and shellfish contaminated with hydrocarbons from the oil spill (Fall 1990; McClintock 1989). As Kroll-Smith and Couch noted regarding technological accidents, "Toxic chemicals leaching through underground swales or asbestos fibers floating through the air, for example, do not level buildings . . . chemical or gaseous contamination of essential *natural resources* is often largely invisible" (1989, p. 3). Physical signs of pollution do not necessarily include just the immediately visible pollution. Alaskan natives are keen observers of their natural environment. Over time, evidence of sick eagles, dead deer, or armless starfish also contribute to perceptions of pollution (Fall 1990).

In an NRC, immediate contamination of natural resources is similar to any non-NRC. However, the situation is further compounded by socioeconomic loss of renewable natural resources and the cultural deprivation in terms of the AUC. In an analysis of social indicators in a native village in Alaska, Jorgensen, McCleary, and McNabb concluded:

The naturally-occurring, renewable, extractable resources are keys to the maintenance of traditional ties beyond the community. Any event which would disrupt subsistence resource harvests or cause people to procure fewer resources will have far-reaching effects in NANA (Northwest Alaska Native Association) and APIA (Aleutian-Pribilof Islands Association) society. (1985, p. 14)

The results of our research demonstrate that patterns of disruption from the Valdez oil spill may change in terms of source and intensity. Over time, less family disruption was observed, whereas perceptions of disruption in the workplace and community increased. This pattern may be characteristic of long-term impacts of technological disasters for NRCs. Occupational roles and the identity of the community are intimately related to resource use. Uncertainty generated by the spill regarding the status and future use of this resource may have negative consequences well into the future.

## CONCLUSIONS

A complete understanding of the social impacts resulting from the Valdez spill will take continued long-term monitoring. The subsistence origin of coastal fishing communities traditionally links present communities to the natural environment. This traditional relationship between nature and culture has been conceptualized as the NRC. A comprehensive evaluation of the NRC model should include longitudinal research on seasonal cycles of preparation, harvesting, utilization, and anticipation. The value of this model extends to indigenous village communities worldwide. Recent initiatives to develop oil resources and offshore oil exploration are ongoing in this region (U.S. Department of the Interior 1990, p. 48144). The NRC model may be useful for social impact assessment and planning in areas potentially impacted by oil extraction or transportation activities. In view of the increasing potential for technological disasters in the third world, the NRC model may also be useful for developing culturally appropriate responses to social change and economic loss as a result of the disruption of subsistence activities (Wolfe and Walker 1987).

Community restoration and recovery programs can also use the NRC model. Most responses to community disruption use standardized research schemes and questionnaires that may be culturally inappropriate. Restoration may also be culturally inadequate in that cash compensation for cultural disruption in cases of native American communities is often misguided. For example, in a study of social disruption in a native American community, Fernandez (1987) pointed out that loss of a natural resource (irrigation water) fundamental to community survival could not be "compensated" by cash payments. In fact, he suggested that some form of communal restoration (desired by respondents) instead of individual recompense for economic or social loss was most appropriate: "To suggest cash payments to individuals as a form of settlement disregards the stated desires of the Sobobans as a group, and, implicitly, denies these Native Americans their birthright" (Fernandez 1987, p. 8).

A similar approach may be appropriate for the NRCs of Prince William Sound. Residents should be allowed to work toward communal restoration based on traditions of social co-

operation rather than by imposition of culturally inappropriate responses emphasizing individual cash compensation. Such restoration activities appear limited, however, given the confrontative nature of litigation activities that characterize technological disaster (Gill and Picou 1989).

Residents of Prince William Sound, native and nonnative alike, have long been stewards of their renewable natural resources. They understand the intricacies of nature conveyed by Walt Whitman in his poem dealing with *Homo sapiens'* relationship to the ecosystem. Such intricacies need to be understood for providing culturally appropriate responses for mitigating the negative impacts of disasters in NRCs. Alaskans and Alaskan natives living in NRCs are human indicators of ecosystem health. The restoration of cultural integrity and well-being are just as valuable as the restoration of the natural environment on which Alaskan natives subsist.

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