COASTAL NORTH CAROLINA SOCIOECONOMIC STUDY

VOLUME V

SOCIOECONOMIC MONITORING DESIGN AND METHODOLOGY

Submitted By:

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FINAL TECHNICAL REPORT

FOR THE

COASTAL NORTH CAROLINA SOCIOECONOMIC STUDY

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5.0 SOCIOECONOMIC MONITORING DESIGN AND METHODOLOGY

The Coastal North Carolina Socioeconomic Study follows the recommendation of the North Carolina Environmental Sciences Review Panel (ESRP) that current socioeconomic and sociocultural conditions among potentially affected populations should be documented prior to exploration for oil and/or gas along the North Carolina Outer Continental Shelf (OCS).

The Environmental Sciences Review Panel (ESRP) was appointed in December 1990. The Oil Pollution Act (OPA) of 1990 directed the Secretary of the Interior, in cooperation with the State of North Carolina, to appoint this panel to assess existing information necessary for the Secretary to make decisions regarding permitting, leasing, exploration and development offshore North Carolina. After a series of deliberations and public hearings, the ESRP identified a number of informational inadequacies and recommended that a comprehensive socioeconomic study be undertaken in the potentially affected region.

This volume, Socioeconomic Monitoring Design and Methodology, presents a plan for monitoring change in the study counties and communities and also describes the research methods used in the current project.

5.1 GENERAL RESEARCH METHODS AND DATA SOURCES

A number of research methods were utilized in the development of the *Draft Final Technical Report* for the CNCSS. This section reviews both the primary and secondary methods implemented during the course of the study and also describes some of the sources of information utilized.

5.1.1 Secondary Source Research

The review of existing materials, published and unpublished, served a number of purposes in the current research. First, the process provided researchers with background knowledge of area history and current socioeconomic and sociocultural issues. This knowledge allowed the researchers to approach the first-hand collection of information in coastal counties and communities with an understanding of historic trends and currently salient issues. Second, secondary source research served to identify the kinds of data that have already been collected and/or compiled in the study areas. This gave the researchers a more comprehensive sense of the kinds of community issues that have been pursued in the past, and from what sources that information was gathered and could possibly be gathered for present purposes. Finally, secondary source research allowed the researcher to judge the value and relevance of existing information. This enabled incorporation of valuable and relevant information into the new work, and identification of those areas where existing data were either missing entirely or in need of clarification, further development, or update during primary data collection efforts.

A wide variety of information has been developed to describe various aspects of life along the North Carolina coast. A working bibliography has been included in this technical report to provide the reader and researchers with a reference source for existing information.

5.1.2 Observation

Once existing literature on the community and environs was compiled, reviewed and summarized, researchers initiated work in the study area to compile primary data. These data were derived from two data collection means: observation and interviews. The interview techniques used in the project are discussed below. This subsection discusses the two main observational techniques that were used in the current project: participant observation and non-reactive observation.

5.1.2.1 Participant Observation

Participant observation is a standard methodology for social science research and was an important part of the primary source research effort for this project, particularly in the case of the community studies. Participant observation requires that the researcher: (1) establish rapport with persons contacted in the community; (2) behave in an interactive but, as far as possible, unobtrusive manner while in the community; and (3) observe and record, from this objective but interactive vantage point, the workings and attributes of the community. Unobtrusive behavior while interacting with persons in the community, purposive observation, and the ability to incorporate observations into a meaningful assessment of the community social context were the main components of participant observation in this study.

In the present research, participant observation was used whenever possible while the researchers were based in the study communities or while they were visiting other parts of the study area. Formal and informal events and daily activities in the community provided ideal situations for this methodology. In these instances, data collection included observing and recording the number and role of participants in local events and activities, their general categories of age, sex, ethnicity, the objective of the event or activity, decision-making processes and social interaction among participants. This research method was particularly useful for contextualizing data gathered through more focussed interview techniques, and for developing an overall sense of community structure.

5.1.2.2 Non-Reactive Observation

While using non-reactive observational methods the researchers did not interact directly with community residents, but systematically recorded information about observable physical attributes of the communities and overall study area. The advantage of non-reactive observation lies in avoidance of sensitizing or biasing citizens about issues of interest to the

researcher through the questioning process. Since the researcher is a direct observer, this technique assures collection of reliable and valid data. For example, non-reactive methods were effective for determining the number, location and type of dwelling units in a community. This method, of course, is ineffective in determining how citizens feel about their homes, how much rent they pay, how they like their neighbors, and so on. These types of questions were more appropriately addressed through directed interview methods.

For the present research, non-reactive observation and secondary source research were used to characterize general, observable aspects of the study communities and overall study area. Perceptually-oriented information was pursued through participant observation and other interactive methods including interviewing methodology.

5.1.3 Interviews

Unlike secondary source research and non-reactive observational methods, interviewing methods bring the researcher into direct contact with the community populations in ways similar to participant observation. Interviews were conducted concurrently with participant observation, and as a separate effort to collect data. In general, interviews are more focussed than participant observation. It is important to recognize that each of the data collection methods used for this research resulted in differing types and richness of data which, when subjected to analysis, provided insight into relationships that would otherwise not be recognized or understood. Further, not only one type of interview was implemented. From the perspective of Bernard (1988), interviewing methods exist on a continuum of the level of control the interviewer exercises over the responses of the interviewees. At one end of this continuum *informal interviewing* was be used; this involved the researcher in conversation with community residents in the absence of formal structure or control over the topics or course of the dialogue. This method was particularly desirable at the beginning of the fieldwork as part of a participant observation process and was valuable for developing an understanding of pertinent issues. *Unstructured interviewing* involved somewhat of a structured approach in that both the researcher and the interviewee discussed specific topics but without a designated protocol or set course of conversation. *Semi-structured interviewing* was valuable when a defined set of information was being pursued from individuals with time constraints (e.g., governmental officials, store owners, etc.). Although the topic is known and defined information was sought, there was not the level of control over the interviewee's responses inherent in the *structured interview.*[1]

The unstructured interview methodology was valuable in collecting information from average citizens considered to be valuable sources for perceptually-oriented information about a number of topics. The semi-structured interview methodology was particularly valuable in

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[1] The type of structured interview methodologies that generate the most directly comparable responses are those that use surveys or questionnaires. These methods were not be used to generate primary data for this project. However, information generated through the use of surveys in some earlier research was reviewed and incorporated for descriptive purposes as appropriate.

pursuing descriptive information relating to local government, community socioeconomics, infrastructure, and similar topics.

The accuracy and reliability of information collected was assured through cross-validation or "triangulation" processes, that is, by checking information against numerous sources as well as by multiple research methods, where possible. Sampling techniques were important in determining the reliability and validity of information gathered through the interview process.

5.1.3.1 Interview Sampling

Before the interviewing process was initiated, a process for selecting interviewees -- a sampling strategy -- was addressed. Two basic sampling strategies were used for this project. First, since a number of research projects have been completed in the study area and researchers are generally familiar with these, many persons who have proven to be valuable sources of information were readily identifiable. By asking central persons in the community who might be a good person or persons to talk with about a specific issue or issues, a name or names were mentioned. These persons were, in turn, asked to identify persons considered knowledgeable about the issue at hand. Eventually, this *network* or *snowball* sampling method yielded the person or persons deemed by the community as most knowledgeable on the issue at hand. This kind of strategy was also useful for developing a general understanding of social networks in the community. The snowball sampling method was therefore used in the present project to identify individuals knowledgeable of certain topics, and as an aid in investigating social relations within the communities and study area.

5.1.3.2 Key Person Interviews

"Key person" or "key informant" interviews can assume any of the interview types outlined above, but are always conducted with individuals in the area or community who possess general knowledge about the community and key areas of interest in the community or area. Typically, but not necessarily, these persons are local governmental officials or key business persons, and are easily identified through the snowball sampling method.

Since this project is intended to describe current conditions along the North Carolina Coast for basic social and economic variables, much of the information collected is descriptive of structural and functional aspects of community conditions. Key business and governmental workers in the community were the best sources for this kind of information, since their relationship with and/or daily tasks in the community demand that they have an intimate knowledge of the local economy, services provided, infrastructure, and so forth. Key persons also typically have a good sense of how the community perceives issues of current interest or importance, and were thus queried on perceptual issues as well.

5.1.3.3 Reputational Leaders

A subcategory of "key person" is the reputational leader. Reputational leaders are often but not necessarily key persons for an overall area or community; rather, these persons can be considered knowledgeable within a *specific sector* of a community or as having knowledge of a *specific or esoteric issue(s)*. Reputational leader interviews were particularly useful in the community case studies when a fine level of detail about specific issues was sought or when specific information from within a group or within a community was needed. Like key persons who have a broad understanding of an area or community, reputational leaders or experts are typically readily identifiable through a snowball sampling process in which persons are asked to give the name of a person or persons in the community most knowledgeable about a given issue or representative of a certain group. When numerous persons repeatedly mentioned an individual or individuals, these were contacted for an interview. For instance, if the researcher wished to contact someone knowledgeable about the history of the crabbing industry in a given area, a socially-recognized "expert" on the topic was interviewed. Similarly, if the perspectives of a local interest group or other community group was desired, a socially-recognized leader from that group was interviewed.

5.1.4 Elicitation Methods for Perception Issues

An important component of the current study focuses on the way in which coastal North Carolina residents value the ocean and coastal environment, how they use that environment, and the perceived processes through which change occurs to that environment. The following describes the research methods that were used to investigate perception among a sample of key persons in each of the seven study communities. This subsection focuses on application of free-listing and pile sort techniques and associated data analyses.

5.1.4.1 Free-listing: Background and Applications for Perception Research in the Study Communities

Free-listing is used in the social sciences to identify culturally-relevant ideas within specific areas or "domains" of human perception. Informants are asked specific questions designed to elicit statements about the domain of interest. The same kinds of questions are presented to a sufficient number and type of informants so that the researcher gathers a range of perceptions about the domain from the cultural group in question. The selection of individuals is not intended to be fully representative of a population, but rather informants are selected to represent a variety of points of view. In this project, between five and eight key persons and reputational leaders residing in each of the study communities were selected for participation in the free-listing process.

This kind of research has been conducted in a variety of settings to define human perception of a wide variety of topics. For instance, Weller (1984) asked groups of Mexican and American women to list as many kinds of disease as they could think of. Weller identified twenty-seven frequently-used terms among the Mexican sample and twenty-nine among the American sample. This listing process allowed the researcher to develop an understanding of the cognitive domain of disease and the way in which the two groups or cultures of women think about kinds of disease. Weller then used the disease terms in subsequent research and was assured that she was using terms that had meaning for the groups whose ideas about disease she was investigating.

Within the sphere of perceptual studies, our principal research interest is in understanding the items, events and processes residents in the study communities perceive as changing their lifestyles. We used the free-listing procedure as the first step in this objective. In order to define the cognitive boundaries of resident's perceptions about what constitutes change in their lives and environment, we investigated three interrelated domains of perception. The first domain involved resident's perceptions about why they like living in the area. By developing an understanding of resident's perceptions about the qualities that make the North Carolina coast a desirable place to live, we are able to describe what actually is at stake when residents discuss their ideas about things that threaten the area. Research of the second domain served the same purpose; we tapped into ideas about the ways people use the region's natural surroundings in order to understand what aspects of the physical environment are valued and are considered to be at risk. Finally, we elicited key informant's perceptions about things that have the potential to change the area.

Free-listing Protocol for Domain One: Qualities of Place We asked residents a simple but specific set of questions in order to tap perceptions about the desirability of their communities and region as a place of residence. The questions address both the physical and social environmental attributes of the area:

> *We are interested in finding out how local people think about the environment in this area.*

> (1) *Please list the natural surroundings in this area that make this a place you want to live.*

> (2) *Please list the qualities that make this area a place you want to live.*

Past use of questions such as (1) above in similar research settings indicates the possibility that residents may ask what is meant by the term "natural surroundings." The most appropriate response for field researchers was to offer an alternative definition of the term that has the same meaning. Researchers thus responded by stating: "I mean the parts of the natural environment that are important to you." Similarly if participants asked what was meant by "qualities" as the term appears in question (2), field researchers replied: "I mean what is important to you about the natural or social environment or way of life here."

Free-listing Protocol for Domain Two: Uses of the Environment The second domain of interest is local perception about ways in which people use the natural surroundings in the coastal zone. The following types of questions were used to elicit perceptual data related to use of the environment in the area:

(1) *Please list the different ways that people here use the local environment (including the ocean, the beach, the sounds and marshes and the woods).*

(2) *Please list the different ways that you as a _____ (e.g., fisherman, sailor, etc.) use the local environment.*

Free-listing Protocol for Domain Three: Perception of Change Once we established an idea of what participants value in terms of the area's physical and social environments, we then investigated perceptions about how these environments might be changed. We sought to define culturally-relevant ideas about those items, events, or processes that residents perceive as presenting a risk to the social and physical environment of the coastal zone through use of the following types of questions:

(1) *Please list the kinds of things that could happen to change the local environment (including the ocean, the beach, the sounds and marshes and the woods).*

(2) *Please list the things that could happen to make life in this community better.*

(3) *Please list the things that could happen to make life in this community worse.*

Question (1) above is designed to elicit a broad range of items, events, and processes including those not necessarily considered to present the potential for negative effects. For instance, construction of a jetty may be considered as a negative or threatening action to some residents but not to others. Elicitation of risk items that have neutral or double meanings are critical to phases of our research in which we seek to determine how people categorize things that could change the area and the relative probability that these *would* change the area if they were to occur.

Free-listing Field Procedure Prospective participants were contacted by phone or in person to request their participation, during which time they were informed of the purpose and nature of the research. Appointments were set and interviews were conducted at the informant's leisure.

Responses to the protocols were recorded on a data collection form then transferred to computer. Additional qualitative data generated during the interviews was also recorded and computerized. These data are contained in Volume IV of this Technical Report.

Free-listing Data Analysis Data generated through the free-listing methods described above were analyzed by reviewing the responses and searching for those that occur most frequently. Researchers using the free-listing method have typically found that informants will offer a core set of responses for each domain in question. It can be argued that the responses made with the highest frequency represent the most culturally relevant or normative set of perceptions for the sample being studied. Free-listing also typically generates a broad range of unique responses. Although such responses are not considered insignificant, they are usually too idiosyncratic to be used in subsequent data collection strategies.

5.1.4.2 Pile-sorting: Background and Applications for Perception Research in the Study Communities

A relatively new and powerful research method is available to investigate some of the social dimensions of perception. Pile-sorting is a method wherein informants are exposed to a set of stimuli in order to elicit perceptions about the domain of interest to the researcher. These stimuli can take the form of actual objects such as plants, or pictures of objects, or cards containing printed words. Informants are asked to manipulate (sort) the objects or representations in specific ways in order to elicit perceptions about the domain of interest. The behavior of informants in performing this task can then be compared across individuals or groups of individuals. The pile-sort method was conducted with twenty informants in each of the study communities, and with nineteen informants in an inland-based population of coastal user groups.

The pile-sort method has been used in a variety of research settings. For instance, Johnson (1989) compared the manner in which expert and novice fishermen judged the similarity of different species of fish. He had informants sort pictures of fish into piles based on perceived similarity among the species. In the current study, the research team used cards containing printed words for the pile-sorts. Each card depicted one of the high frequency ideas, events, or processes generated through the free-listing method. Informants were asked to order the cards into piles in which items in each pile were considered to be somehow similar. They were then asked to explain why they sorted the items the way they did. This procedure allowed the research team to further its understanding of how coastal residents perceive the area's social and physical environment and associated uses and threats by: (1) identifying categories and dimensions of ideas people use to define the three areas of interest; and (2) comparing groups and individuals in terms of these classification schemes.

Informants were also asked to order the cards into piles in a manner that approximated a Likert scaling procedure. Likert scaling involves having participants assign a value to an object or idea based on how they perceive it along some dimension of interest to the researcher. For instance, a respondent might be asked to assess the likelihood that the President will reduce the federal deficit by ten percent within two years. In order to standardize the options for response, the researcher might ask the respondent to assess this likelihood on a scale of one to five where one represents the highest likelihood and five

represents the lowest likelihood. This strategy was used in conjunction with the pile-sort method in the current study. Informants were asked to place items into as many as five piles where items in each pile represent a value between one five in a Likert scale.

Pile-sorting methods are effective means for investigating perception and thus allow the researcher to closely replicate the research with other groups and/or at other times. The following describes the specific procedures we used to implement the method in the current project.

Field Procedure: Pile-Sorting for Perceived Similarity High frequency statements elicited through the three free-listing protocols were printed in large type on small plastic-coated cards. In order to insure that participants would be able to effectively think about and manipulate the items on the cards and perform the pile-sorting tasks, the number of statements used for each domain was limited to around twenty-four. This number varied slightly depending upon the natural cut-off point of response frequency determined through analysis of the free-listing data.

Pile-sort interviews were conducted at a later date with the same informants who participated in the free-listing task. Pile-sorts were also conducted with a larger sample of key persons in local government and business and interest groups in the communities (total N=20 in each community). Interviews began with a brief set of questions designed to gather basic information about the individual, his or her relationship to the organization he or she represented, and about the organization itself. Other basic information about the respondent was also recorded, including participation in other groups; this was valuable in determining whether such participation could have some bearing upon perception within our domains of interest.

Pile-sort interviews were also preceded by elicitation of what key persons perceive to be the most important issues currently confronting residents of the communities. This procedure increased the construct validity of the subsequent data collection process by providing a means for measuring the relevance of the information on the cards in relation to issues of perceived importance to the larger sample of key persons.

Informants were then asked to order the first set of cards -- high frequency statements about the attractive qualities of the social and physical environment in the communities -- into piles of items they considered to be similar. The following simple direction was most effective in guiding the respondent: "If you would, please take these cards and make as many piles as you wish. . . each pile should be made up of items that are somehow similar in your mind." The cards were numbered to allow easy recording of the items placed in each pile. A form was used to standardize data collection and recording.

Once the respondent constructed the piles, he or she was asked to explain what the piles represented; that is, why the piles were constructed as they were. This information was

elicited by asking: "what is this pile all about?" or "can you describe this pile in a phrase?" This qualitative information was also recorded on the data collection form.

The Likert scaling/pile-sort procedure was implemented next. What is measured by the scale varied for each domain of interest. For the set of cards representing desirable attributes of the communities, the participants were asked to order the cards based on their perceptions about the relative accuracy of the statements describing the community. Informants were asked to order the cards into as many as five piles where the first pile represented those items considered most accurate in describing their community through the fifth pile which contained items considered to be least accurate in describing their community. The informants were then asked to explain their rationale for including each of the items placed in pile one.

The similarity and Likert scale sorting processes and associated qualitative data collection were repeated with the remaining two sets of cards -- the cards representing perceptions about how people use the environment and the cards representing things key persons perceive to change the environment and their lifestyles. Likert scaling for uses of the environment measured perceptions about what are the *most common uses of the environment* in the communities and region. Scaling for perception measured the perceived *likelihood that the item would change the community if it were to occur tomorrow*.

Pile-sorting Data Analysis There are a variety of powerful analytical techniques available to assist in interpreting data generated through pile-sorting methods. The data gathered through the Likert-scaling/pile-sorting method is being analyzed in a relatively straightforward manner, while the similarity data will be analyzed using a variety of techniques.

In analyzing the scaling data we simply determined the frequency with which items in each of the domains were assigned a specific scale value by informants. That is, we sought to determine, for instance, the percentage of the sample who believe item x is most accurate in describing their community. Interpretation of these statistical data is augmented by contextualizing it with the associated qualitative data.

We used a software package called ANTHROPAC (Borgatti, 1992) to analyze the similarity data. This program analyzes pile-sort data by organizing them into item-by-item correlation matrices; that is, into tables in which pairs of items are scored as similar if they appear in the same pile. Correlation matrices are developed for individuals and were also combined across groups. The matrices were analyzed using multi-dimensional scaling, hierarchical clustering and cultural consensus analysis (Weller and Romney, 1988).

Multi-dimensional Scaling Multi-dimensional scaling (MDS) is an analytical technique used to identify and graphically depict relationships among a set of observations. The correlation matrix discussed above depicts observations about the perceived similarity of all of the items in each domain. These data are quantifiable in that each pair of items is assigned a value of 1 if informants judge them to be similar by placing them in a pile together. Items judged to

be dissimilar (placed in separate piles) are assigned a value of 0. The relative distance of items can thus be quantified in terms of similarity; closely related items achieve high correlation values and close proximity, and unrelated items achieve low correlation and are proximally distant. MDS is a tool that allows graphic depiction of correlation and proximity between items.

For example, Weller (1984) used free-listing data about disease terminology in a subsequent similarity pile-sorting task (in the manner of the current study) and generated a 27 X 27 item correlation matrix. Based on this matrix she used MDS to illustrate how her sample of women thought about names of diseases. MDS allowed her to plot, in two-dimensional space, the degree of correlation between items. Closely related items (items perceived to be very similar) appeared close to each other on the plot and unrelated items appeared distant. Since groupings of items represented close relationships of disease terms in the minds of her informants, Weller was able to see that her sample grouped diseases into distinct categories that could be explained in terms of labels such as gastrointestinal disorders, contagious diseases, and so on (Bernard 1988:451).

ANTHROPAC software was used in the current study to depict the perceived relationships of items in each of the categories of interest generated through MDS. Data analyses included comparison of MDS across informants and study groups. Thus, we were able to describe and compare the major categories of perceived risk, for example, across communities. Data can also be analyzed for comparison across business groups, municipal governments, interest groups, and so on.

Hierarchical Clustering Hierarchical clustering is another analytical technique that assists in characterizing perceived similarity between items. The technique allows the researcher to identify the most proximate pair of items and then progressively merge items into clusters based on degree of similarity. This method complements MDS in that it helps to explain groupings of items (clusters) as they appear on the MDS plots. Hierarchical clustering was used in the current study as an aid in explaining the MDS plots.

Cultural Consensus Modelling There is yet another valuable technique available for analyzing similarity data. The Cultural Consensus Model (Romney, Weller and Batchelder, 1986) is particularly well-suited for estimating the degree to which informants agree about the similarity of items in the domains of interest, and for inferring the "culturally correct answer key" for correspondence among items.[2]

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[2] The Cultural Consensus Model quantifies agreement across respondents through calculation of a matrix of matches adjusted for guessing. The matrix is then factor analyzed and the ratio between the first and second eigenvalue indicates whether the assumption of cultural knowledge is met. For the assumption to be met, the first factor, which represents competence or level of cultural understanding for the domain in question, should be several times larger than the second, accounting for the structure in the matrix apart from sampling variability (see Garro, 1988 or Romney, *et al.*, 1986). The Model makes a number of assumptions: (1) the respondents share major elements of a single culture, hence each item (k) has a "culturally correct" answer, in this case another matching or non-matching item, (2) each respondent replies independently of other respondents to each sort, and (3) each

In the current study, the Cultural Consensus Model combined the correlation matrices developed for each respondent's pile-sorts to generate an aggregate correlation matrix that represented the "mean" set of judgements about similarity of items across the entire sample. That is, for each domain of interest, the model generated a table that depicts the group consensus about which items in the domains were perceived as being similar (and/or dissimilar). Once an aggregate correspondence matrix was generated, it was possible to gauge how individual participants "scored" in relation to the mean or consensual perception held by the entire sample. Cultural consensus scores are valuable in our efforts to measure variability among individuals and groups of individuals in the sample.

5.1.5 General Analytic Approach

The overarching objective of this project is to develop a set of technical reports that are highly descriptive of historical trends and current socioeconomic conditions along those areas of the North Carolina coast potentially affected by OCS-related activities at the Manteo Prospect. Analysis of data collected for this purpose is largely comparative and explanatory. That is, patterns in information collected were sought through comparison of trends over time, and comparison of conditions by community and county. Human affairs in the study area are thus described and explained based on patterns revealed in analysis of demographic and economic trends and in comparison of social and cultural systems across the region.

5.2 SOCIOECONOMIC MONITORING: DEVELOPMENT OF A PRELIMINARY LONGITUDINAL OCS MONITORING DESIGN

This section outlines and describes clusters of variables that may be tested as indicators of change potentially associated with OCS-related development in coastal North Carolina. They have been selected on the basis of four major criteria: (1) they correspond to those variables for which projections were made in the anticipatory impact assessment; (2) they are helpful in understanding the kinds of changes likely to occur in association with future OCS activity that are specific to the study area (i.e., coastal North Carolina); (3) they help to distinguish changes resulting from OCS activities from other changes not associated with OCS; and (4) they are intended to facilitate the tracking of changes -- at a minimum of cost and effort -- over a long period of time. These variables were selected on the basis of the empirical data collected in the baseline socioeconomic impact assessment and a review of socioeconomic

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respondent (i) has an equal capability of correctly answering each question; that is, the domain of questioning is coherent for all participants and guessing will lead to disagreement. The model also adjusts for respondents making uninformed guesses about the similarity of items. Thus, the empirical point estimate of the proportions of matches between informants i and j when corrected for guessing is $M_{ij} = (LM_{ij}-1)/(L-1)$, where $M_{ij} = M_{ji}$ for all pairs of respondents (after Romney, Weller and Batchelder, 1986:320).

impact assessments and monitoring programs of other energy-related developments in general and OCS-related developments in particular.

5.2.1 The Requirements for Socioeconomic Monitoring

One of the requirements for an adequate monitoring program is the capability to utilize monitored information for updating impact projections (Leistritz and Chase 1981; Leistritz and Murdock 1981). Events which may disrupt a sociocultural system should be anticipated and analyzed by socioeconomic modeling and assessed periodically in a longitudinal fashion using a monitoring strategy that requires the periodic collection and analysis of key variables. Thus, the structure of the monitoring system and the models used in the anticipatory impact assessment are fundamentally linked together such that the demands of the model dictate the structure of the monitoring system.

Effective socioeconomic models and monitoring programs must satisfy several important features regarding structure and implementation. The structural features are: (1) identifying the *key elements* of the system; (2) describing the *interrelationships* of these elements; and (3) specifying the *status of the key elements* at a point in time (i.e., base case). The key elements of a sociocultural system usually included in monitoring programs are often placed into two general categories: (1) those reflecting project characteristics and (2) those reflecting changes in the communities affected by the project. As described by Leistritz and Chase (1981:336-337):

> Key project characteristics generally considered for inclusion in a monitoring system include the number of workers, worker characteristics (e.g., local vs. non-local origin, place of residence, number and ages of dependents, etc.), and percentage of project completion. Community characteristics generally included in monitoring efforts are those indicators of the demands placed on local facilities and services and the capacity of local systems. Examples of such indicators include population, school enrollments, housing units available or under construction, capacity of sewer and water systems, capacity (space and personnel) of local schools, law enforcement activity (number of calls and arrests) and capacity (staff and equipment), and revenues and expenditures of local governments.

The implementation features are: (1) assuring the accessibility, reliability and validity of the data used in the model and monitoring methodology; (2) making explicit the propositions -- based on theory or empirical data -- explaining how the key elements are interrelated; (3) projecting the status of key elements across time; (4) comparing those projections with data collected periodically from the monitoring program and revising the projections accordingly; and (5) applying the model to situations for which it was developed (Leistritz 1986; Carley

and Bustelo 1984; Finsterbusch and Wolf 1981; Murdock and Leistritz 1980). Socioeconomic models and monitoring programs are most useful when each of these tasks are performed.

Socioeconomic monitoring methods and the models upon which they are based are widely used, including applications to social impact assessment studies (Wolf 1983), post-disaster studies (Edelstein 1989; Kreps 1989), and in socioeconomic impact management programs (Leistritz and Murdock, 1981; Santa Barbara County 1988). Socioeconomic modeling and monitoring efforts tend to examine economic gains and losses (U.S. Department of Commerce 1983; Friesema 1979). However, recent studies of socioeconomic impacts of energy-related disasters show that economic and social well-being are each significant. In fact, some of these studies suggest that sociocultural and psychosocial impacts (i.e. social well-being impacts) are among the most severe outcomes of such events because they disrupt the basic functioning of community social and economic groups (Kroll-Smith and Couch 1990; IAI 1990b). Such disruptions impede collective action for response activities, upset cooperative working relationships, and otherwise harm the ties that integrate communities (Shkilnyk 1985). Thus, the literature about socioeconomic impact assessments indicates the need for modeling and monitoring economic and sociocultural impacts *and* their interactions.

5.2.2 The Application of Socioeconomic Modeling and Monitoring in OCS Development

Diverse economic and sociocultural approaches have been applied to modeling socioeconomic impacts of energy-related development in general and OCS-related development in particular. Some of these models use a qualitative approach to describe the socioeconomic and sociocultural system of a particular community (Galginaitis et al. 1984; Luton 1985; IAI 1983a, 1983b, 1987a) or a group of communities (Ellanna 1980; Little and Robbins 1984; IAI 1982; 1987b, 1990a), including techniques to extrapolate indicators of economic and social conditions. Other models focus on quantitative approaches to modeling economic or selected social conditions (e.g., Huskey and Kerr 1980; Knapp, Colt and Henley 1986; Berger and Associates 1983; Lamphear, Schmidt and Konecny 1986). These quantitative approaches are similar to modeling techniques used elsewhere (c.f. Murdock et al. 1982; Denver Research Institute 1979; Ford 1976; Leistritz et al. 1978; Mountain West Research 1978; South and Bragan 1981). Seldom are both qualitative and quantitative approaches combined, although integrated modeling overcomes the different limitations of each approach (Brewer and Hunter 1989).

Qualitative models are useful because of their utility in describing the details and features of system elements and the complex connections and interactions among these elements. This feature is an asset for analysis of the complexity of a sociocultural system with numerous elements and interconnections (Kirk and Miller 1986). Similarly, qualitative models can be used for causal analysis in situations where quantitative models can be used only for analysis of covariation (Lofland 1971:59-74). Qualitative models used in conjunction with quantitative techniques can thus increase the explanatory power of a research approach (Brewer and Hunter 1989). Qualitative models are useful for predicting the future status of

system elements as long as there is a strong foundation of empirical data which can be used to extrapolate how system elements and their interconnections may change because of a particular event. This foundation is frequently present in the form of extensive analysis of system elements that attends to both the current as well as the historical status of these elements (e.g., Luton 1985). A frequent criticism of these models is that they are developed to describe a specific occurrence which may limit their ability to be generalized to other situations (Strauss 1987). However, this limitation can be overcome when qualitative and quantitative modeling are integrated.

The strengths and weaknesses of socioeconomic models, in turn, influence the choice of indicators to be included in a monitoring program. For instance, the strengths of quantitative monitoring methods are in increasing reliability, validity, and comparability of data, thus increasing the precision for testing theories (Johnson 1978). Reliability is increased by using replicable quantitative measures. Validity is increased because quantitative methods preserve a record of negative cases that may not fit a pattern researchers are trying to establish. Comparability is increased by facilitating quantitative comparisons across settings. Indeed, quantitative monitoring programs are often developed to be generalized across various settings where standardized data (e.g., employment data) are easily available about a particular topic. A limitation of quantitative monitoring programs is that they are ill-suited to handling large numbers of complex variables. Similarly, quantitative data are not applicable to all significant events and issues in a social system. However, these limitations are precisely the strengths of qualitative approaches, further indicating the utility of combining qualitative and quantitative approaches (Brewer and Hunter 1989).

The use for which a monitoring program was constructed is also an essential consideration in the application of either quantitative and qualitative techniques. A program to monitor the impact of proposed changes in fish and game regulations or establishing a new national park will stress key elements of a region's socioeconomic system that differ from those in a program used to monitor the impacts of offshore oil development. Each change in the environment, whether intentional (as in regulatory changes for leasing offshore oil) or unintentional (e.g., the *Exxon Valdez* oil spill), is likely to have specific effects on a region's socioeconomic system that are not uniform. Consequently, whether the monitoring methods are primarily quantitative or qualitative, their use will be maximized when they are applied to those conditions for which they were developed and for which valid and reliable data exist. Additionally, their application in any regional context must take into consideration the following: (1) the unique historical and environmental conditions of the systems being studied; (2) the cultural values of the observer but not the observed; (3) the cultural meanings attached to similar behaviors, e.g., fishing has distinct cultural meanings for Natives and non-Natives in Alaska (Palinkas, Harris and Petterson, 1985).

In summary, the successful development of a useful socioeconomic monitoring program for OCS-related development requires knowing what needs to be measured, testing the validity and reliability of the selected variables, having a baseline of those variables, and knowing how the variables relate to each other. It also requires an understanding of the impact itself

and the techniques of monitoring and mitigation that are specific to that impact, an appreciation of the systems of meaning which underlay a socioeconomic system under study, and an ability to integrate both qualitative and quantitative data for the purposes of describing the existing socioeconomic system and making predictions as to the characteristics of that system across time. The variables described below would support the monitoring of OCS-related development by emphasizing an integrated socioeconomic approach that is based on the type of development to be modeled and using extensive baseline data to implement the model.

A review of the literature on socioeconomic impact assessment and monitoring of energy-related projects in general (Chalmers and Anderson 1977; Freudenberg 1983; Murdock and Leistritz 1979; Thomas, Hamm and Murdock 1983; USDOE 1991) and OCS-related development in particular (Berger and Associates 1983; Lamphear, Schmidt and Konecny 1986) indicates that five clusters of variables are usually monitored as indicators of social and economic change associated with energy-related development. They include the following:

Economic--including changes in regional income, employment and business activity

Demographic--including changes in regional, county, and community population, population settlement patterns, and population characteristics

Fiscal--including the level and distribution by jurisdiction (county, city, school district) of public costs and revenues

Community Service--including changes in the quantity, distribution, and quality of water and sewer services, educational services, health care services, police and fire, transportation, social, and other services

Social--including changes in social or community organization, community perceptions, and the effects of specific groups, such as the elderly, minorities and people on fixed incomes.

We describe below the variables that we believe may be important to enable future analysts to monitor and assess the effects of changes associated with OCS development. It must be emphasized that these monitoring variables have been selected as possible indicators of change potentially associated with OCS-related development. They are intended to facilitate the tracking of changes -- at a minimum of cost and effort -- over a long period of time. They have been selected on basis of one or more of the following criteria: (1) are they essential to understanding the kinds of changes likely to occur in association with future OCS activity (i.e., essentiality); (2) will they help to distinguish changes resulting from OCS activities from other changes not associated with OCS (i.e., sensitivity); (3) will they measure changes to which local communities may be particularly sensitive (susceptibility); or (4) are they unlikely to be available if they are not maintained intentionally and specifically for the particular purpose (i.e., otherwise unavailable)? The variables are, for the most part,

consistent with those employed in the development of the base case. For purposes of the monitoring plan, however, we have taken the additional step of describing how particular clusters of variables could best be monitored over time. Where appropriate, we have also suggested monitoring approaches which appear to be most cost effective. We would emphasize that before any particular indicator is adopted by a monitoring system, its validity and reliability must be firmly established.

5.2.2.1 Variables of Particular Analytical Importance: Case Study Communities

The following variables are recommended for longitudinal monitoring. These are important in efforts to understand changing conditions in the study area.

demography
  total population
  median age
  percent of persons sixty-five or older
  ethnicity by percent
  total households
  average number of persons per household
  percent owner-occupied units
  percent renter-occupied units/vacancy rate
  number mobile homes
  number units vacant for seasonal use
  seasonal variation in population
  current local population issues
economy
  seasonal variation in local economy
  current local economic issues
education
  facilities
  number of local students
  programs
social services
  coverage area
  usership
marine facilities
  number by type
water and sewer system
  related problems
solid waste disposal
  related problems
current infrastructure-related issues
  land use patterns
  land ownership
  zoning and land use
  special policies
  hazard areas
  visual considerations
  current land use-related issues

lifeways, lifestyles
        intracommunity variation
social structure
        importance of kinship ties
        social stratification
        community factions
        locally-defined and prioritized aesthetic values/perception of risk issues
        perceived quality of place
        perceived common uses of the environment
        perceived sources of change to the community and environment
        locally-defined and prioritized social and cultural issues
        perceptions about physical changes to the community
        perceptions about changes to the environment
        perceptions about changes in the fishing industry
        perceptions about changes in property value

5.2.2.1 Demographic Indicators

The first cluster of indicators may be used to monitor changes that occur in population size, distribution and composition as a result of OCS development. This includes both standard trends such as population increases that normally accompany a large development or special effects such as outmigration of residents due to increased safety concerns or decreased quality of life.

Changes in population size may be assessed by periodic monitoring of total population, population growth rate, length of residence, and rates of immigration and outmigration. Total population and population growth rate are important in assessing the demand for community services and local resources as well as on the availability and constraints on fiscal resources (tax revenues, budget allocations).

Length of residence and rates of immigration and outmigration are important because as measures of population stability, they are both consequences of population size and important predictors of projected changes in population size. These measures also provide important indicators of the sociocultural structure of the community (e.g., differences in values and level of commitment to the community held by transients vs long-term residents).

Changes in population distribution may be monitored by collecting data on population size and growth rate within sub-units of the study area and by an assessment of population density. Population density is necessary to assess whether the impacts are distributed uniformly within a region or community or whether some areas are more heavily impacted than others given the location of development and availability or preference accorded to housing.

Changes in population composition may be monitored by collecting data on the following characteristics of both OCS-related immigrants and total population of the study area: age, gender, ethnicity, marital status, education, household income, and household size. These

variables are important for a number of reasons. In one sense, they are necessary for projections of the level of demand on selected elements of the other systems of the study area. For instance, an increase in the proportion of the population under the age of 18 will have implications for the demand placed on educational facilities and services. A decline in the proportion of working age adults will have implications for the supply of tax revenues necessary to provide essential community services. Ethnicity, education and household income serve as indicators of community diversity and integration, values, and perception of risk. Household size and marital status will be necessary to project future demands for housing. All of these variables also serve as indicators necessary to evaluate and revise projections of the demand for employment opportunities.

5.2.2.2 Economic Indicators

Should the introduction of OCS-related development significantly change the balance of economic activities, it might also alter other social and economic patterns. Changes in economic activity can be measured by means of a number of variables including: (1) regional economic activity; (2) employment; (3) income distribution; (4) property values; (5) commercial fisheries; (6) recreational fisheries; and (7) tourism.

Regional Economic Activity: Morgan City, Louisiana could serve as an example of how OCS development can lead to the gradual displacement of a predominantly fishing community by oil support operations -- leaving the community without a viable economic base when these support operations fell into decline.[3] While this does not appear to be a significant threat to coastal North Carolina communities, the variables that would need to be monitored in order to track changes in the regional economy are similar. They include changes in economic activity, income distribution, property values, commercial fisheries harvest, landings, and earnings, recreational vessel and landing data, and tourism.

Employment: Changes in the composition of employment, as reflected in changes in percentages of SIC codes, provide a quantitative measure of overall changes in the economy. Information obtained from OCS-related industries such as payroll, local/regional expenditures, capital investment, and subcontract data might prove valuable in measuring any future direct economic consequences of OCS activities. This information, in turn, could prove useful to the analysis of indirect effects such as changes in tax bases, revenues, and expenditures that result from the direct economic changes.

Income Distribution: Changes in the distribution of income resulting from OCS activities can be imputed in a number of ways. While the 1990 Census provides a detailed understanding of this distribution by census tracks and blocks, this information can only serve as a base

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[3] The example of Morgan City, La., is used as an extreme example where impacts resulted from a major field development in the Gulf of Mexico which has continued over a lengthy period of time. The case in the Atlantic is relatively benign by comparison.

against which to measure changes resulting from OCS activities. This base itself, however, has undergone changes since the census was completed and must therefore be used with care. It should be possible, at least for monitoring purposes, to take the information on actual or anticipated employment and income characteristics to project (or measure) changes in the skew, geographic distribution (where residence information is available), of actual or anticipated employees.

Property Values: Changes in local property values are determined through both existing databases, such as appraised tax values and through perceptions of key persons (e.g., land and realty appraisers, realty company employees, local planners, etc.) and realty owners and renters in the study area. These variables would prove useful in the event of a serious oil spill that adversely affected recreational use patterns, resale value of homes, or other property values. These variables would be of use only in the immediate vicinity of a minor on-shore development.

Commercial and Recreational Fisheries: Changes in the pounds of species landed and associated market values would be important monitoring variables that could be maintained by the North Carolina Division of Marine Fisheries, and by the National Marine Fisheries Service. In the case of oil spills, these will be central areas of concern by both local and non-local user groups. Interviews with key persons in the fishing and fish processing sectors should be used to assist in contextualizing these quantitative data. Within the recreational sector, key persons in recreational fishing organizations, in tour organizations, in hotel and motel associations, and associated industries could provide similar contextual information that would be essential to understanding and interpreting changes associated or not associated with onshore or offshore OCS development or with oil spills believed or assumed to derive from such development.

Tourism: Tourism data is maintained, to a limited degree by county and municipal governments in the study area, and by community business associations and organizations. These data need to be updated with key person interviews in agencies, departments, or private organizations charged with managing or monitoring tourism in the area. More will need to be known about tourist patterns, in terms of points of origin, the bases of destination preferences (retirement, commercial fishing, recreational fishing, vacation, etc.), the specifics of seasonal rounds, and the costs or values associated with these different patterns.

5.2.2.3 Locally Active Governmental Institutions and Services

Provision of service by locally active government agencies and institutions is an important monitoring variable to test. Government service delivery is critical to the welfare of existing populations but can be constrained by many factors, including population growth and change. Description of existing government services and service delivery is updated by ongoing description of change in the populations served, responses by the government

agencies/institutions, and policy change. These data must be derived from observational and interviewing methods.

5.2.2.4 Sociocultural Indicators

A wide variety of indicators will be used to monitor social and cultural conditions in the study area. These will be focused on the community level. These variables include those related to the lifeways and social structure (as listed in Section 5.2.2.1).

Long term assessment of changes in these variables within the populations of interest will call for periodic implementation of specific research methods including secondary source research, key person interviews, observation, and similarity judgements and Likert scaling techniques.

Following is a complete list of variables used to describe socioeconomic and sociocultural conditions in the study area.

Physical/Biological Environment

    Endangered species listings
    Principal species utilized for subsistence of commercial purposes and important associated management plans and regulations

Population Characteristics

    Total Population
    Age/Gender Distribution
        median age
        percent of persons under five
        percent of persons under eighteen
        percent of persons sixty-five or older
    Ethnicity by percent
    Household Characteristics
        total households
        average number of persons per household
        percent of married-couple families
        percent of male householder families
        percent of female householder families
        percent of non-family households
        percent of householders sixty-five or older
    Housing Information
        total housing units
        percent owner-occupied units
        percent renter-occupied units/vacancy rate
        number mobile homes
        number vacant housing units
        number units vacant for seasonal use

Seasonal variation in population
Current local population issues

Economic Characteristics

Local business/industry
    number of businesses by type
        marine-related
        tourism-related
        food services
        lodging
        medical
        construction
    facilities
Sources of employment and number of personnel employed
    public sector
    private sector
Seasonal variation in local economy
Current local economic issues

Locally Active Governmental Institutions and Services

Federal Government
    locally active agencies and programs
State Government
    locally active agencies and programs
County Government
    law enforcement
        coverage area
    fire prevention and suppression
        coverage area
    emergency medical services
        programs
        coverage area
    education
        facilities
        number of local students
        programs
    social services
        coverage area
        programs
    cultural and recreational services
        programs
Community Government
    local government issues

Physical Infrastructure and Land Use
     marine facilities
          number by type
     transportation system
          programs
          roads usage
          road quality
     water and sewer system
          related problems
     solid waste disposal
          related problems
     energy
     communications
     current infrastructure-related issues
     land use patterns
          land ownership
          zoning and land use
               special policies
          hazard areas
          visual considerations
     current land use-related issues

Social and Cultural Characteristics

Sociocultural Aspects of the Community
     lifeways, lifestyles
          intracommunity variation
     religion/churches
          number by type
          membership
     clubs and service organizations
          type
          membership
     interest groups and other voluntary associations
          type
          membership
     social structure
          importance of kinship ties
          social stratification
          community factions
     locally-defined and prioritized aesthetic values/perception of risk issues
          perceived quality of place
          perceived common uses of the environment
          perceived sources of change to the community and environment
     locally-defined and prioritized social and cultural issues
     perceptions about physical changes to the community
     perceptions about changes to the environment
     perceptions about changes in the fishing industry
     perceptions about changes in property values

5.2.3 Recommended Monitoring Tool

The key to a successful monitoring program (or socioeconomic impact assessment) is the ability to examine the interrelationships among a wide range of independent data bases (geographic, environmental, survey, tax assessor, land use, transportation, census, etc.). Traditional socioeconomic monitoring programs, however, have tended to treat such variables as independent and encapsulated. That is, they evaluate changes in demographic patterns (e.g., age, sex, or ethnicity) on the basis of a particular measure (age) and a particular data base (the U.S. Census) across time. Survey data is typically analyzed internally for the kinds of changes it was designed to measure. Similarly, secondary data on seasonal migration, business permits, tax assessor records, license issuance, traffic and accident patterns, are only compared internally and analyzed as independent variables.

These data sets, and the patterns they represent, however, are all closely interrelated and interdependent. What is lacking is the ability to interrelate and simultaneously compare multiple data sets, covering multiple time periods, over a wide range of geographies (location specific, local government jurisdiction, county, region or state, etc.). This is now possible by use of sophisticated geographic information systems (GIS) that enable an analyst to portray information on a map as a data overlay or "coverage." For example, U.S. Census data on age, sex, or ethnicity can be organized and presented on maps by block or block group. The different percentages of each can be presented as shaded or colored polygons as a data overlay or "coverage."

But these systems are not limited merely to the presentation of information in the form of maps. They offer profound analytic capabilities as well. For example, age, sex, and ethnicity characteristics, available at the census block level, can be "attributed" or linked to street addresses such that all households in a certain block are assumed to have the characteristics of the block (which, for such small geographies, is normally a fair statistical assumption). This attributed file can then serve as a basic building block for the subsequent linkages to other files.

For example, tax assessor data can be linked to addresses, color coded, and portrayed on maps as a geographic distribution -- by date of purchase (showing high and low growth rate areas), appraised property values (appreciation rates, high versus low income areas), date of construction (showing construction trends and direction), and so on.

But these linkages are by no means limited to "addressed" data. Information derived even from such sociological tools as surveys can be attributed or tied to point (e.g., latitude/longitude), polygon (e.g., a census block), or line (e.g., street location or address) geography. If, for example, we can assume that a particular survey is of sufficient size to be statistically valid, and contains a set of standardized demographic questions, we can then show the geographic distribution of the values, beliefs, or attitudes reflected in the survey, by age, sex, income, ethnicity, or any other demographic variable collected in the survey itself.

That is, these relationships can be shown on map as a data overlay or "coverage" of areas of a community that, for example, fit the criteria of being predominantly over-sixty, on fixed income, greater than $40,000 annual income, white, and so on, that are characteristic of retirement communities. Similarly, we can show areas that included a disproportionate number of females, large family size, under the age of 40, middle income, and so on, that tend to correspond with strong opposition to certain kinds of development.

This attitudinal data can then be used to demonstrate relationships that were not part of the survey -- perhaps age distribution, which were not represented in the original survey such that new questions, if not answers, can be derived from the analysis of the associations.

Gradually, by building and interrelating data layers, and comparing them over time, the analyst can begin to see patterns that would not be accessible (or so clearly evident) by means of traditional analytic methods. These patterns of interrelationships are the critical key to understanding the process and outcome of social change situations.

The MMS analyst charged with the task of evaluating actual and potential sources of social change associated with Outer Continental Shelf oil development, once such a system were developed, would be able to integrate and analyze information from a multitude of sources. It is our recommendation that the tool most amenable to addressing this task is a geographic information system, one that had been configured to enable the analyst to easily and quickly compare and contrast, across varying dimensions of time, across a wide range of environmental, geophysical, social, demographic, economic, cultural, and political information resources available at the local, regional, state, and national levels.

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