CHAPTER 1: INTRODUCTION TO VOLUME TWO

INTRODUCTION

Coastal habitats provide ecological, cultural, and economic value. They act as critical habitat for thousands of species, including numerous threatened and endangered species, by providing shelter, spawning grounds, and food (Mitsch and Gosselink 2000). They often act as natural buffers, providing ecological, social, and economic benefits by filtering sediment and pollution from upland drainage thereby improving water quality, reducing the effects of floodwaters and storm surges, and preventing erosion. In addition to these ecosystem services, healthy coastal habitats provide many human values including opportunities for:

- Outdoor recreation and tourism
- Education
- Traditional use and subsistence lifestyles
- Healthy fishing communities, and
- Obtaining other marketable goods

Therefore, healthy functioning coastal habitats are not only important ecologically, they also support healthy coastal communities and, more generally, improve the quality of human lives. Despite these benefits, coastal habitats have been modified, degraded, and removed throughout the United States and its protectorates beginning with European colonization (Dahl 1990). Thus, many coastal habitats around the United States are in desperate need of restoration and subsequent monitoring of restoration projects.

WHAT IS RESTORATION MONITORING?

The science of restoration requires two basic tools: the ability to manipulate ecosystems to recreate a desired community and the ability to evaluate whether the manipulation has produced the desired change (Keddy 2000). The latter is often referred to as restoration monitoring.

For this manual, restoration monitoring is defined as follows:

> "*The systematic collection and analysis of data that provides information useful for measuring project performance at a variety of scales (locally, regionally, and nationally), determining when modification of efforts are necessary, and building long-term public support for habitat protection and restoration*."

Restoration monitoring contributes to the understanding of complex ecological systems (Meeker et al. 1996) and is essential in documenting restoration performance and adapting project and program approaches when needs arise. If results of monitoring restored coastal areas are disseminated, they can provide tools for planning management strategies and help improve future restoration practices and projects (Washington et al. 2000). Restoration monitoring can be used to determine whether project goals are being met and if mid-course corrections are necessary. It provides information on whether selected project goals are good measures for future projects and how to perform routine maintenance in restored areas (NOAA et al. 2002). Monitoring also provides the basis for a rigorous review of the pre-construction project planning and engineering.

Restoration monitoring is closely tied to and directly derived from restoration project goals. The monitoring plan (i.e., what is measured, how often, when, and where) should be developed with project goals in mind. If, for example, the goal of a restoration project is to increase the amount of fish utilizing a coastal marsh, then measurements should be selected that can quantify progress toward that goal. A variety of questions about sampling techniques

and protocols need to be answered before monitoring can begin. For the fish utilization example, these may include:

- Will active or passive capture techniques be used (e.g., beach seines vs. fyke nets)?
- Where and when will samples be taken?
- Who will conduct the sampling?
- What level of identification will be required?
- What structural characteristics such as water level fluctuation or water chemistry will also be monitored and how?
- Who is responsible for housing and analyzing the data?
- How will results of the monitoring be disseminated?

Each of these questions, as well as many others, will be answered with the goals of the restoration project in mind. These questions need to be addressed before any measurements are taken in the field. In addition, although restoration monitoring is typically thought of as a 'post-restoration' activity, practitioners will find it beneficial to collect some data before and during project implementation. Pre-implementation monitoring provides baseline information to compare with post-implementation data to see if the restoration is having the desired effect. It also allows practitioners to refine sampling procedures if necessary. Monitoring during implementation helps insure that the project is being implemented as planned or if modifications need to be made.

Monitoring is an essential component of all restoration efforts. Without effective monitoring, restoration projects are exposed to several risks. For example, it may not be possible to obtain early warnings indicating that a restoration project is not on track. Without sound scientific monitoring, it is difficult to gauge how well a restoration site is functioning ecologically both before and after implementation. Monitoring is necessary to assess whether specific project goals and objectives (both ecological and human dimensions) are being met, and to determine what measures might need to be taken to better achieve those goals. In addition, the lack of monitoring may lead to poor project coordination and decreased efficiency.

Sharing of data and protocols with others working in the same area is also encouraged. If multiple projects in the same watershed or ecosystem are not designed and evaluated using a complementary set of protocols, a disjointed effort may produce a patchwork of restoration sites with varying degrees of success (Galatowitsch et al. 1998-1999) and no way to assess system-wide progress. This would result in a decreased ability to compare results or approaches among projects.

CONTEXT AND ORGANIZATION OF INFORMATION

In 2000, Congress passed the *Estuary Restoration Act (ERA), Title I of the Estuaries and Clean Waters Act of 2000*. The ERA establishes a goal of one million acres of coastal habitats (including those of the Great Lakes) to be restored by 2010. The ERA also declares that anyone seeking funds for a restoration project needs to have a monitoring plan to show how the progress of the restoration will be tracked over time. The National Oceanic and Atmospheric Administration (NOAA) was tasked with developing monitoring guidance for coastal restoration practitioners whether they be academics, private consultants, members of state, Tribal or local government, non-governmental organizations (NGOs), or private citizens, regardless of their level of expertise.

To accomplish this task, NOAA has provided guidance to the public in two volumes. The first, *Science-Based Restoration Monitoring of Coastal Habitats, Volume One: A Framework*

for Monitoring Plans Under the Estuaries and Clean Waters Act of 2000 (Public Law 160-457) was released in 2003. It outlines the steps necessary to develop a monitoring plan for any coastal habitat restoration project. *Volume One* briefly describes each of the habitats covered and provides three matrices to help practitioners choose which habitat characteristics may be most appropriate to monitor for their project. Experienced restoration practitioners, biologists, and ecologists as well as those new to coastal habitat restoration and ecology can benefit from the step-by-step approach to designing a monitoring plan outlined in *Volume One*.

Volume Two, *Tools for Monitoring Coastal Habitats* expands upon the information in *Volume One* and is divided into two sections **Monitoring Progress Toward Goals** (Chapters 2-14) and **Context for Restoration** (Chapters 15-18). The first section, Monitoring Progress Toward Goals includes:

- Detailed information on the structural and functional characteristics of each habitat that may be of use in restoration monitoring
- Annotated bibliographies, by habitat, of restoration-related literature and technical methods manuals, and
- A chapter discussing many of the human dimensions aspects of restoration monitoring

The second section, Context for Restoration includes:

- A review of methods to select reference conditions
- A sample list of costs associated with restoration and restoration monitoring
- An overview of an online, searchable database of coastal monitoring projects from around the United States, and
- A review of federal legislation that supports restoration and restoration monitoring

The Audience

Volumes One and *Two* of *Science-Based Restoration Monitoring of Coastal Habitats* are written for those involved in developing and implementing restoration monitoring plans, both scientists and non-scientists alike. The intended audience includes restoration professionals in academia and private industry, as well as those in Federal, state, local, and Tribal governments. Volunteer groups, non-governmental organizations, environmental advocates, and individuals participating in restoration monitoring planning will also find this information valuable. Whereas *Volume One* is designed to be usable by any restoration practitioner, regardless of their level of expertise, *Volume Two* is designed more for practitioners who do not have extensive experience in coastal ecology. Seasoned veterans in coastal habitat ecology, however, may also benefit from the annotated bibliographies, literature review, and other tools provided.

The information presented in *Volume Two* is not intended as a 'how to' or methods manual: many of these are already available on a regional or habitat-specific basis. *Volume Two* does not provide detailed procedures that practitioners can directly use in the field to monitor habitat characteristics. The tremendous diversity of coastal habitats across the United States, the types and levels of impact to them, the differing scales of restoration activities, and variety of techniques used in restoration and restoration monitoring prevent the development of universal protocols. Thus, the authors have taken the approach of explaining *what one can measure during restoration monitoring, why it is important*, and *what information it provides* about the progress of the restoration effort. The authors of each chapter also believe that monitoring plans must be derived from the goals of the restoration project itself. Thus, each monitoring effort has the potential to be

unique. The authors suggest, however, that restoration practitioners seek out the advice of regional experts, share data, and use similar data collection techniques with others in their area to increase the knowledge and understanding of their local and regional habitats. The online database of monitoring projects described in Chapter 17 is intended to facilitate this exchange of information.

The authors do not expect that every characteristic and parameter described herein will be measured, in fact, very few of them will be as part of any particular monitoring effort. A comprehensive discussion of all potential characteristics is, however, necessary so that practitioners may choose those that are most appropriate for their monitoring program. In addition, although the language used in *Volume Two* is geared toward restoration monitoring, the characteristics and parameters discussed could also be used in ecological monitoring and in the selection of reference conditions as well.

MONITORING PROGRESS TOWARDS GOALS

The progress of a restoration project can be monitored through the use of traditional ecological characteristics (Chapters 2 - 13) and/or emerging techniques that incorporate human dimensions (Chapter 14).

THE HABITAT CHAPTERS

Thirteen coastal habitats are discussed in twelve chapters. Each chapter follows a format that allows users to move directly to the information needed, rather than reading the whole text as one would a novel. There is, however, substantial variation in the level of detail among the chapters. The depth of information presented reflects the extent of restoration, monitoring, and general ecological literature associated with that habitat. That is, some habitats such as marshes, SAV, and oyster reefs have been the subject of extensive restoration efforts, while others such as rocky intertidal and rock bottom habitats have not. Even within habitats there can be considerable differences in the amount of information available on various structural and functional characteristics and guidance on selecting parameters to measure them. The information presented for each habitat has been derived from extensive literature reviews of restoration and ecological monitoring studies. Each habitat chapter was then reviewed by experts for content to ensure that the information provided represented the most current scientific understanding of the ecology of these systems as it relates to restoration monitoring.

Habitat characteristics are divided into two types: structural and functional. Structural habitat characteristics define the physical composition of a habitat. Examples of structural characteristics include:

- Sediment grain size
- Water source and velocity
- Depth and timing of flooding, and
- Topography and bathymetry

Structural characteristics such as these are often manipulated during restoration efforts to bring about changes in function. Functional characteristics are the ecological services a habitat provides. Examples include:

- Primary productivity
- Providing spawning, nursery, and feeding grounds
- Nutrient cycling, and
- Floodwater storage

Structural characteristics determine whether or not a particular habitat is able to exist in a given area. They will often be the first ones monitored during a restoration project. Once the proper set of structural characteristics is in place and the biological components of the habitat begin to become established, functional characteristics may be added to the monitoring program. Although structural characteristics have historically been more commonly monitored during restoration efforts, measurements of functional characteristics provide a better estimate of whether or not a restored area is truly performing the economic and ecological services desired. Therefore, incorporating measurements of functional characteristics in restoration monitoring plans is strongly encouraged.

When developing a restoration monitoring plan, practitioners should follow the twelve-step process presented in *Volume One* and refer to the appropriate chapters in *Volume Two* (habitat and human dimensions) to assist them in selecting characteristics to monitor. The information presented in the habitat chapters is derived from and expands upon the *Volume One* matrices (*Volume One* Appendix II).

Organization of Information

Each of the habitat chapters is structured as follows:

1. Introduction
   a. Habitat description and distribution
   b. General ecology
   c. Human impacts to the habitat
2. Structural and functional characteristics
   a. Each structural and functional characteristic identified for the habitat in the *Volume One* matrices is explained in detail. Structural and functional characteristics have generally been discussed in separate sections of each chapter. Occasionally, some functions are so intertwined with structural characteristics that the two are discussed together.
   b. Whenever possible, potential methods to measure, sample, and/or monitor each characteristic are introduced or readers are directed to more thorough sources of information. In some cases, not enough information was found while reviewing the literature to make specific recommendations. In these cases, readers are encouraged to use the primary literature cited within the text for methods and additional information.
3. Matrices of the structural and functional characteristics and parameters suggested for use in restoration monitoring
   a. These two matrices are habitat-specific distillations of the *Volume One* matrices
   b. Habitat characteristics are cross-walked with parameters appropriate for monitoring change in that characteristic. Parameters include both those that are direct measures of a particular characteristic as well as those that are indirectly related and may influence a particular characteristic or related parameter. Tables 1 and 2 can be used to illustrate an example. The parameter of salinity in submerged aquatic vegetation is a direct measure of a structural characteristic (salinity, Table 1). In addition, salinity is related to other structural characteristics such as tides and water source. Salinity is also related to functional characteristics such as biodiversity and nutrient cycling and may be appropriate to include in the monitoring of these functions as well (Table 2). Experienced practitioners will note that many characteristics and parameters may be related to one another but are not shown as such in a particular matrix. The matrices are not intended to be all inclusive of each and every possible interaction. The matrices provided and the linkages illustrated are only intended as starting points in the process of developing lists of parameters that may be useful in measuring particular characteristics and understanding some of their interrelationships.
   c. Some parameters and characteristics are noted as being highly recommended for any and all monitoring efforts as they represent critical components of the habitat while others may or may not be appropriate for use depending on the goals of the individual restoration project.
4. Acknowledgement of reviewers
5. Literature Cited

Three appendices are also provided for each habitat chapter. In the online form of *Volume Two,* these appendices download with the rest of the habitat chapter text. In the printed versions of *Volume Two*, each chapter's appendices are provided on a searchable CD-ROM located inside the back cover. Each appendix is organized as follows:

Appendix I - An Annotated Bibliography

a. Overview of case studies of restoration monitoring and general ecological studies pertinent to restoration monitoring
b. Entries are alphabetized by author

Parameters to Monitor the Structural Characteristics of SAV (excerpt)

Parameters to Monitor	Biological	Physical			Hydrological				Chemical	
	Habitat created by plants	Sediment grain size[1]	Topography / Bathymetry	Turbidity	Tides / Hydroperiod	Water sources	Current velocity	Wave energy	Nutrient concentration	pH, salinity, toxics, redox, DO[2]
Chemical										
Salinity (in tidal areas)					●	●				●

Table 1. Salinity is a parameter that can be used to directly measure a structural component of submerged aquatic vegetation habitats (Chemical/salinity). It is shown with a closed circle indicating that it highly recommended as part of any restoration monitoring program, regardless of project goals. A circle for salinity is also shown under the **Tides/Hydroperiod** and **Water source** columns as salinity levels are related to these structural characteristics as well. (Entire table can be found on page 9.39.)

Parameters to Monitor the Functional Characteristics of SAV (excerpt)

Parameters to Monitor	Biological									Chemical		
	Contributes primary production	Supports biomass production	Provides breeding grounds	Provides nursery areas	Provides feeding grounds	Provides refuge from predation	Supports high biodiversity	Supports a complex trophic structure	Provides substrate for attachment	Supports nutrient cycling	Modifies chemical water quality	Modifies dissolved oxygen
Chemical												
Salinity (in tidal areas)							❍			❍		

Table 2. Salinity is related to the functions of **Supporting high biodiversity** and **Supporting nutrient cycling**. It is shown here with an open circle, denoting that it may be useful to monitor if monitoring of these functions is important to the goals of the restoration project. (Entire table can be found on page 9.40.)

[1] Including organic matter content.
[2] Dissolved oxygen.

Appendix II - Review of Technical and Methods Manuals

These include reviews of:

a. Restoration manuals
b. Volunteer monitoring protocols
c. Lab methods
d. Identification keys, and
e. Sampling methods manuals

Whenever possible, web addresses where these resources can be found free of charge are provided.

Appendix III - Contact information for experts who have agreed to be contacted with questions from practitioners

As extensive as these resources are, it is inevitable that some examples, articles, reports, and methods manuals have been omitted. Therefore, these chapters should not be used in isolation. Instead, they should be used as a supplement to and extension of:

- The material presented in *Volume One*
- Resources provided in the appendices
- The advice of regional habitat experts, and
- Research on the local habitat to be restored

WHAT ARE THE HABITATS?

The number and type of habitats available in any given estuary is a product of a complex mixture of the local physical and hydrological characteristics of the water body and the organisms living there. The ERA Estuary Habitat Restoration Strategy (Federal Register 2002) dictates that the Cowardin et al. (1979) classification system should be followed in organizing this restoration monitoring information. The Cowardin system is a national standard for wetland mapping, monitoring, and data reporting, and contains 64 different categories of estuarine and tidally influenced habitats. Definitions, terminology, and the list of habitat types continue to increase in number as the system is modified. Discussion of such a large number of habitat types would be unwieldy. The habitat types presented in this document, therefore, needed to be smaller in number, broad in scope, and flexible in definition. The 13 habitats described in this document are, however, generally based on that of Cowardin et al. (1979).

Restoration practitioners should consider local conditions within their project area to select which general habitat types are present and which monitoring measures might apply. In many cases, a project area will contain more than one habitat type. To appropriately determine the habitats within a project area, the practitioner should gather surveys and aerial photographs of the project area. From this information, he or she will be able to break down the project area into a number of smaller areas that share basic structural characteristics. The practitioner should then determine the habitat type for each of these smaller areas. For example, a practitioner working in a riparian area may find a project area contains a *water column, riverine forest, rocky shoreline*, and *rock bottom*. Similarly, someone working to restore an area associated with a tidal creek or stream may find the project area contains *water column, marshes, soft shoreline, soft bottom*, and *oyster beds*. Virtually all estuary restoration projects will incorporate characteristics of the water column. Therefore, all practitioners should read *Chapter 2: Restoration Monitoring of the Water Column* in addition to any additional chapters necessary.

Habitat Decision Tree

A Habitat Decision Tree has been developed to assist in the easy differentiation among the habitats included in this manual. The decision tree allows readers to overcome the restraints of varying habitat related terminology in deciding which habitat definitions best describe those in their project area. Brief definitions of each habitat are provided at the end of the key.

1. a. Habitat consists of open water and does not include substrate (**Water Column**)
   b. Habitat includes substrate (go to 2)
2. a. Habitat is continually submerged under most conditions (go to 3)
   b. Habitat substrate is exposed to air as a regular part of its hydroperiod (go to 8)
3. a. Habitat is largely unvegetated (go to 4)
   b. Habitat is dominated by vegetation (go to 7)
4. a. Substrate is composed primarily of soft materials, such as mud, silt, sand, or clay (**Soft Bottom**)
   b. Substrate is composed primarily of hard materials, either of biological or geological origin (go to 5)
5. a. Substrate is composed of geologic material, such as boulders, bedrock outcrops, gravel, or cobble (**Rock Bottom**)
   b. Substrate is biological in origin (go to 6)
6. a. Substrate was built primarily by oysters, such as *Crassostrea virginica* (**Oyster Reefs**)
   b. Substrate was built primarily by corals (**Coral Reefs**)
7. a. Habitat is dominated by macroalgae (**Kelp and Other Macroalgae**)
   b. Habitat is dominated by rooted vascular plants (**Submerged Aquatic Vegetation - SAV**)
8. a. Habitat is not predominantly vegetated (go to 9)
   b. Habitat is dominated by vegetation (go to 10)
9. a. Substrate is hard, made up materials such as bedrock outcrops, boulders, and cobble (**Rocky Shoreline**)
   b. Substrate is soft, made up of materials such as sand or mud (**Soft Shoreline**)
10. a. Habitat is dominated by herbaceous, emergent, vascular plants. The water table is at or near the soil surface or the area is shallowly flooded (**Marshes**)
    b. Habitat is dominated by woody plants (go to 11)
11. a. The dominant woody plants present are mangroves, including the genera *Avicennia*, *Rhizophora*, and *Laguncularia* (**Mangrove Swamps**)
    b. The dominant woody plants are other than mangroves (go to 12)
12. a. Forested habitat experiencing prolonged flooding, such as in areas along lakes, rivers, and in large coastal wetland complexes. Typical dominant vegetation includes bald cypress (*Taxodium distichum*), black gum (*Nyssa sylvatica*), and water tupelo (*Nyssa aquatica*). (**Deepwater Swamps**)
    b. Forested habitat along streams and in floodplains that do not experience prolonged flooding (**Riverine Forests**)

Water column - A conceptual volume of water extending from the water surface down to, but not including the substrate. It is found in marine, estuarine, river, and lacustrine systems.

Rock bottom - Includes all wetlands and deepwater habitats with substrates having an aerial cover of stones, boulders, or bedrock 75% or greater and vegetative cover of less than 30% (Cowardin et al. 1979). Water regimes are restricted to subtidal, permanently flooded, intermittently exposed, and semi-permanently flooded. The rock bottom habitats addressed in *Volume Two* include bedrock and rubble.

Coral reefs - Highly diverse ecosystems, found in warm, clear, shallow waters of tropical oceans worldwide. They are composed of marine polyps that secrete a hard calcium carbonate skeleton, which serves as a base or substrate for the colony.

Oyster reefs - Dense, highly structured communities of individual oysters growing on the shells of dead oysters.

Soft bottom - Loose, unconsolidated substrate characterized by fine to coarse-grained sediment.

Kelp and other macroalgae - Relatively shallow (less than 50 m deep) subtidal and intertidal algal communities dominated by very large brown algae. Kelp and other macroalgae grow on hard or consolidated substrates forming extensive three-dimensional structures that support numerous plant and animal communities.

Rocky shoreline - Extensive littoral habitats on high-energy coasts (i.e., subject to erosion from waves) characterized by bedrock, stones, or boulders with a cover of 75% or more and less than 30% cover of vegetation. The substrate is, however, stable enough to permit the attachment and growth of sessile or sedentary invertebrates and attached algae or lichens.

Soft shoreline - Unconsolidated shore includes all habitats having three characteristics: (1) unconsolidated substrates with less than 75% aerial cover of stones, boulders, or bedrock; (2) less than 30% aerial cover of vegetation other than pioneering plants; and (3) any of the following water regimes: irregularly exposed, regularly flooded, irregularly flooded, seasonally flooded, temporarily flooded, intermittently flooded, saturated, or artificially flooded (Cowardin et al. 1979). This definition includes cobble-gravel, sand, and mud. However, for the purpose of this document, cobble-gravel is not addressed.

Submerged aquatic vegetation (SAV; includes marine, brackish, and freshwater) - Seagrasses and other rooted aquatic plants growing on soft sediments in sheltered shallow waters of estuaries, bays, lagoons, rivers, and lakes. Freshwater species are adapted to the short- and long-term water level fluctuations typical of freshwater ecosystems.

Marshes (marine, brackish, and freshwater) - Transitional habitats between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is covered by shallow water tidally or seasonally. Freshwater species are adapted to the short- and long-term water level fluctuations typical of freshwater ecosystems.

Mangrove swamps - Swamps dominated by shrubs (*Avicenna, Rhizophora*, and *Laguncularia*) that live between the sea and the land in areas that are inundated by tides. Mangroves thrive along protected shores with fine-grained sediments where the mean temperature during the coldest month is greater than 20º C; this limits their northern distribution.

Deepwater swamps - Forested wetlands that develop along edges of lakes, alluvial river swamps, in slow-flowing strands, and in large coastal-wetland complexes. They can be found along the Atlantic and Gulf Coasts and throughout the Mississippi River valley.

They are distinguished from other forested habitats by the tolerance of the dominant vegetation to prolonged flooding.

Riverine forests - Forests found along sluggish streams, drainage depressions, and in large alluvial floodplains. Although associated with deepwater swamps in the southeastern United States, riverine forests are found throughout the United States in areas that do not have prolonged flooding.

THE HUMAN DIMENSIONS CHAPTER

The discussion of human dimensions helps restoration practitioners better understand how to select measurable objectives that allow for the appropriate assessment of the benefits of coastal restoration projects to human communities and economies. Traditionally, consideration of human dimensions issues has not been included as a standard component of most coastal restoration projects. Most restoration programs do not currently integrate social or economic factors into restoration monitoring, and few restoration projects have implemented full-scale human dimensions monitoring. Although some restoration plans are developed in an institutional setting that require more deliberate consideration of human dimensions impacts and goals, this does not generally extend to the monitoring stage. It is becoming increasingly evident, however, that decisions regarding restoration cannot be made solely by using ecological parameters alone but should also involve considerations of impacts on and benefits to human populations, as well. Local communities have a vested interest in coastal restoration and are directly impacted by the outcome of restoration projects in terms of aesthetics, economics, or culture. Human dimensions goals and objectives whether currently available or yet to be developed should reflect societal uses and values of the resource to be restored. Establishing these types of parameters will increase the public's understanding of the potential benefits of a restoration project and will increase public support for restoration activities.

While ecologists work to monitor the restoration of biological, physical, and chemical functional characteristics of coastal ecosystems, human dimensions professionals identify and describe how people value, utilize, and benefit from the restoration of coastal habitats. The monitoring and observation of coastal resource stakeholders allows us to determine who cares about coastal restoration, why coastal restoration is important to them, and how coastal restoration changes people's lives. The human dimensions chapter will help restoration practitioners identify:

1) Human dimensions goals and objectives of a project
2) Measurable parameters that can be monitored to determine if those goals are being met, and
3) Social science research methods, techniques, and data sources available for monitoring these parameters

This chapter includes a discussion of the diverse and dynamic social values that people place on natural resources, and the role these values play in natural resource policy and management. Additionally, some of the general factors to consider in the selection and monitoring of human dimensions goals/objectives of coastal restoration are presented, followed by a discussion of some specific human dimensions goals, objectives, and measurable parameters that may be included in a coastal restoration project. An annotated bibliography of key references and a matrix of human dimensions goals and measurable parameters are provided as appendices at the end of this chapter. Also included, as an appendix, is a list of human dimensions research experts (and their areas of expertise) that you may contact for additional information or advice.

The final four chapters of this manual are designed to provide readers with additional information that should enhance their ability to develop and carry out strong restoration monitoring plans. Chapter 15 reviews methods available for choosing areas or conditions to which a restoration site may be compared both for the purpose of setting goals during project planning and for monitoring the development of the restored site over time. Chapter 16 is a listing of generalized costs of personnel, labor, and equipment to assist in the development of planning preliminary cost estimates of restoration monitoring activities. Some of this information will also be pertinent to estimating costs of implementing a restoration project as well. Chapter 17 provides a brief description of the online review of monitoring programs in the United States. The database can be accessed though the NOAA Restoration Portal (http://restoration.noaa.gov/). This database will allow interested parties to search by parameters and methodologies used in monitoring, find and contact responsible persons, and provide examples that could serve as models for establishment or improvement of their own monitoring efforts. Chapter 18 is a summary of the major United States Acts that support restoration monitoring. This information will provide material important in the development of a monitoring plan. A Glossary of many scientific terms is also provided at the end of the document.

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CHAPTER 14: HUMAN DIMENSIONS OF COASTAL RESTORATION

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INTRODUCTION

Coastal habitat restoration, from an ecological perspective, is primarily aimed at restoring the functional (biological, physical, and chemical) characteristics of coastal ecosystems. These functions, described in the preceeding habitat chapters, can be measured and monitored to gauge the ecological success of a restoration project. From a human dimensions perspective, in contrast, the emphasis is on identifying and describing how people value, utilize and benefit from the restoration of coastal habitats. While ecological and biophysical data are an essential component, decisions regarding coastal restoration projects, and evaluation of their success, will ultimately be based on societal value preferences. The restoration of coastal environments is fundamentally a human endeavor. Failure to address human dimensions issues at the outset of a restoration effort will likely result in rejection by the very community the project is intended to benefit. This is particularly true for coastal public trust resources, which include the water column, submerged lands, beaches, and associated plants and animals. Inquiry into the human dimensions of coastal restoration should begin with three fundamental questions:

1. Who cares about coastal restoration (i.e., who are the **stakeholders**)?
2. Why is coastal restoration important to them?
3. How will coastal restoration change people's lives (i.e., what are the social benefits/ impacts)?

Restoration projects that from the beginning incorporate a human dimensions approach and attempt to answer and address the questions *who cares? and why is it important?,* are more likely to succeed than those that do not. This is true of all restoration efforts, not just those specifically designed to achieve human dimensions benefits. Even restoration efforts aimed primarily at attaining biophysical and ecological goals will need the support from various agencies, organizations, industries, and communities - all of which operate in the human dimensions sphere - to be successful.

Similar to ecological parameters, changes in human values and behaviors associated with coastal restoration, and the social benefits of coastal restoration, can and should be measured and monitored over time. Also as with ecological effects, standard social science procedures and methods should be adhered to in order to properly develop and monitor appropriate human dimensions goals and objectives for coastal restoration projects. Monitoring changes in human thought and action in conjunction with a coastal restoration project will require a multidisciplinary approach. Some of the social science (i.e., human dimensions) disciplines restoration practitioners need to consider include sociology, psychology, resource economics, geography, anthropology, outdoor recreation, and political science. Coastal restoration monitoring will likely necessitate the need for interdisciplinary collaborative research between two or more of these disciplines, as well as research that integrates human dimensions with the ecological and biophysical sciences.

ORGANIZATION OF INFORMATION

This chapter provides those who are engaged in restoration efforts with a basic understanding of the human dimensions of coastal restoration.

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It is intended to help restoration practitioners identify:

1. Human dimensions goals and objectives of coastal restoration projects
2. Measurable parameters that can be monitored to determine if those goals are being met, and
3. Social science research methods, techniques, and data sources available for monitoring these parameters

The next section, *Coastal Restoration: The Role of Social Values,* offers a general discussion of the diverse and dynamic social values that people place on natural resources, and the role these values play in natural resource policy and management. The third section, *Human Dimensions Aspects of Coastal Restoration*, covers some of the general factors to consider in the selection and monitoring of human dimensions goals/objectives of coastal restoration. The fourth section, *Discussion of Specific Goals, Objectives and Measurable Parameters*, provides a discussion of some specific human dimensions goals, objectives and measurable parameters that may be included in a coastal restoration project. A *Matrix of Human Dimensions Goals and Parameters to Monitor* and a *Selected Annotated Bibliography* of key references are provided as appendices at the end of this chapter (Appendices I and II, respectively). Also included as appendices are a *Glossary of Human Dimensions Terms* (terms bolded in text appear in glossary) and a *List of Human Dimensions Experts* (and their areas of expertise) that readers may contact for additional information or advice (Appendices III and IV, respectively).

COASTAL RESTORATION: THE ROLE OF SOCIAL VALUES

Ecological restoration is one component in the broader context of natural resource management (or stewardship) that also includes government regulation, resource allocation, consumer decision-making, and social activism. Natural resource management can be viewed conceptually as the intersection of four interconnected systems:

- Natural environmental system of biosphere elements, natural resources, ecosystems, fish and wildlife etc.
- Political system of policies, courts, laws, regulations, legislators, lobbyists, and management agencies
- Economic system focused on the allocation of land, labor and capital, economic impacts, employment, and budgets
- Social system of human **attitudes, norms,** values, beliefs, behaviors, customs, traditions, motivations and preferences

All four systems are interrelated and interdependent in this model, and the natural system, which is typically the focus of restoration efforts, both provides and receives inputs from the political, economic, and social systems. The political, economic, and social systems collectively make up what is referred to as the *human dimensions* of natural resource management, depicted as everything above the dotted line in Figure 2. However, natural resource values originate and are endorsed in one system only: the social system (Kennedy and Thomas 1995). These values are then expressed to natural resource managers and society through the political, economic, and social systems. In turn, these value expressions (e.g., environmental laws, congressional budgets, volunteerism, voting behavior) largely determine the fate of the natural systems that sustain us.

The important point here is that the natural/environmental system does not originate natural resource values, only people do. There are no pre-determined values in nature that will somehow guide us toward some pre-ordained "correct" ecological condition. While restoration practitioners may ponder the question "what to restore?" an equally important question is "restore to what pre-existing condition, and for what purpose?" That is, do we want our landscapes and coastal habitats to look and function the way they did 50 years ago, 100

Figure 1. Volunteers plant salt marsh plants at the Eastern Neck National Wildlife Refuge on Eastern Neck Island, MD. Photo by NOAA Restoration Center, from the NOAA Photo Library. http://www.photolib.noaa.gov/habrest/r0006505.htm

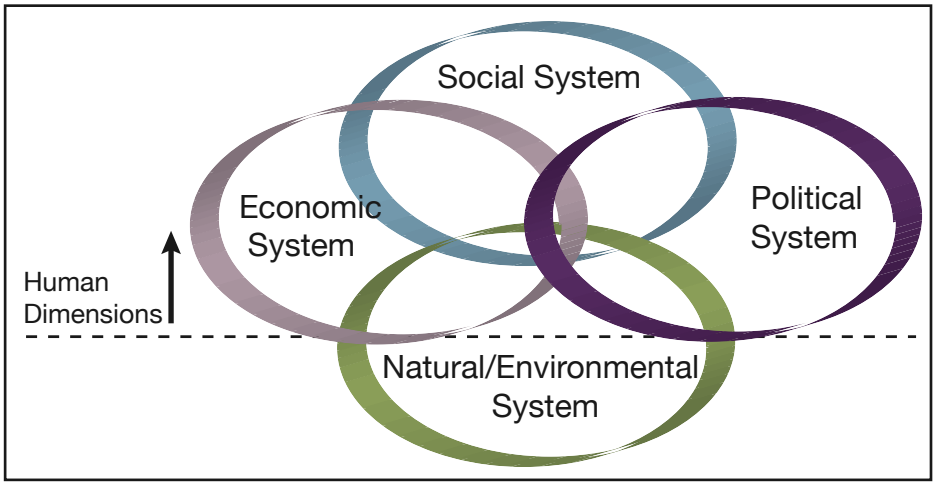


Figure 2. Conceptual model of natural resource management systems. Modified from Kennedy and Thomas 1995.

years ago, or 300 years ago? (if that is even possible); what ecosystem does society want, at what cost, and with what trade-offs? Answers to these questions will only come from the social system and the values society imparts on natural and environmental resources. Ultimately, coastal communities (and other stakeholders) will need to decide what coastal ecosystem they want when deciding on the specific goals and objectives (both ecological and human dimensions) of a particular restoration project. This decision should not be viewed as an absolute dichotomy between a pristine unimpacted ecosystem and a totally impacted ecosystem allowing many types of environmentally damaging human activities. Rather, there is a whole range of possible ecosystem types (from pristine to developed) which present opportunities for compromise when identifying the ecological and human dimensions goals of a restoration project.

In this sense, natural resource management can be viewed as social value management whereby managers strive to balance diverse natural resource social values within current society with the needs and values of future generations in an ecologically sustainable manner (Kennedy and Thomas 1995). Since societal values are what drive natural resource management, all coastal restoration efforts should be viewed as both a recognition of and response to these values. While the actual elements being restored are biological and physical in nature, the reasons for restoring them are human dimensions based (i.e., fish do not vote, osprey do not pay taxes).

Natural resource values are diverse in society and the same object or resource can be valued in many different ways by different people. These values, which are devices of our minds, are shaped by our culture, by society, through scientific discovery, and through our interactions with the natural environment. The diversity of natural resource values can be viewed along a continuum ranging from **human-dominant** to **human-mutual values** (Kennedy and Thomas 1995). Human-dominant values emphasize the use of natural resources to meet basic human needs. These are often described as **utilitarian**, materialistic, consumptive, or economic in nature. An example would be valuing a whale as a source of food and energy. The human-mutual end of this continuum emphasizes spiritual, aesthetic, and nonconsumptive values in nature (e.g., the enjoyment people derive from whale watching). For example, an indigenous tribe may gain sustenance from whale meat and blubber while simultaneously deriving spiritual and heritage (human-mutual) values from a whale hunt. Therefore, values along this continuum are not necessarily mutually exclusive and the same resource can be a source of both values.

When considering social values, a distinction is made between **held values** and **assigned values**. Held values are conceptual precepts and ideals held by an individual about something. Natural resource examples include the symbolism of a

bald eagle or the enjoyment of watching a sunset. Assigned values refer to the relative importance or worth of something, usually in economic terms. Examples include the value of water for irrigation or hydropower, land for development, or forests for timber supply. A similar natural resource value dichotomy is drawn between **non-instrumental** versus **instrumental values**. Non-instrumental values refer to resources that are valued for what they are, whereas instrumental values refer to the usefulness of something as a means to some desirable human end. Aesthetic and spiritual values in nature would be considered non-instrumental whereas economic, utilitarian, and life support values would be considered instrumental. For the most part, human dominant values tend to be assigned and instrumental, whereas human mutual values are typically held and non-instrumental.

Natural resource values are not only diverse in present-day society, they are also continually in flux. A comparison of predominant attitudes towards filling wetlands and whale hunting at the turn of the 20th century with those at the turn of the 21st century illustrates just how much natural resource social values can shift over the course of just a few generations. Several important societal changes took place in the United States during the second half of the 20th century that radically changed how natural resources are managed and how natural resource agencies function. These changes include:

- A general shift in environmental values away from human-dominant (utilitarian and consumptive) and towards the human-mutual/nonconsumptive end of the continuum. This included increased aesthetic/spiritual appreciation of nature, outdoor recreation use values, and animal rights values.
- Raised public environmental awareness and human health concerns related to environmental condition as a result of the environmental movement of the late 1960's early 1970's. This movement resulted in a plethora of environmental laws that still provide the foundation for environmental policy and management to this day.
- More people claiming a stake in environmental resources and demanding input into the natural resource decision-making process. These "new" stakeholders included environmentalists (e.g., non-governmental organizations, grassroots and community groups), landowners, farmers, animal rights groups, nonconsumptive users, and the general public (Decker et al. 1996).
- The role of the judicial system in natural resource policy and management greatly increased as agency actions (and inactions) were successfully challenged more often in court.

Figure 3. Young naturalist inspecting a horseshoe crab shell. The carapace was empty. If this was a live animal, picking up by tail could cause injury to the crab. Photo by Mary Hollinger, NODC biologist, NOAA, from the NOAA Photo Library. http://www.photolib.noaa.gov/coastline/line0682.htm

For natural resource agencies, survival in a post-Earth Day political environment would require a fundamental shift in their relationship with the owners of the resources they held in trust, i.e., society as a whole. Prior to the 1960's, natural resource management was in the hands of professional agency "experts." These experts were well trained in the natural

sciences, and this background was adequate for managing our natural resources. This approach to managing natural resources (be they forests, wildlife, fisheries, etc.) was in response to widespread environmental overuse and damage that occurred in the absence of any significant or meaningful management. During this time, managers worked on behalf of the public, and were able to do what they felt best for the resource. Over time, natural resource agencies increasingly focused their attention on meeting the needs of a relatively small group of "clients" or "constituents" who paid for the agencies services through license sales, special excise taxes (e.g., Sport Fish Restoration Act) and resource lease sales (Decker et al. 1996). For fish and wildlife agencies, these "traditional users" were typically anglers, hunters, and trappers. For commodity driven agencies such as the U.S. Forest Service (USDA) or Minerals Management Service (USDOI) the traditional clients were the logging and oil industries, respectively. The prevailing notion was that the general public need not be concerned with natural resource management which was in the hands of professional agency "experts" (i.e., management based on science, not social values). However, as noted above, changes since the 1960's have significantly altered how we choose to manage and use our natural resources. Demand for resources has grown enormously, conflict over uses is common, values towards what is "right" have changed, and most importantly, the public has demanded to be allowed to participate in the decision-making process. Our environmental laws now require it. While a solid understanding of the natural sciences is essential, the idea that these sciences alone can tell us how to manage natural resources has been increasingly questioned by agencies and the general public. Resource management is today driven by social values. We must determine "why a particular restoration effort is important," and "who cares," if we are to be successful in our efforts.

Figure 4. Seagulls occupying almost every piling along a Tangier Island waterman's dock (Chesapeake Bay, VA). Photo by Mary Hollinger, NODC biologist, NOAA, from the NOAA Photo Library. http://www.photolib.noaa.gov/coastline/line0980.htm

HUMAN DIMENSIONS ASPECTS OF COASTAL RESTORATION: GENERAL FACTORS TO CONSIDER

IDENTIFYING GOALS AND OBJECTIVES

Goals are general statements about desired project outcomes. Goals are typically further defined through multiple objectives, which are more specific statements about desired project outcomes. It is strongly recommended that the human dimensions goals and objectives of a coastal restoration project be identified and clearly stated early in the planning process. Identification and evaluation of goals and objectives should be open to all individuals or groups with a stake in the outcome (i.e., stakeholders) so that everyone has input into and understands, in general terms, the desired direction of the project. It is also suggested that an **adaptive management** approach be incorporated so that goals and objectives can be re-assessed, and modified as needed, at various stages throughout the project's life.

Coastal habitat restoration is driven by desired outcomes (i.e., goals) that can be ecological, social, or economic in nature. Some projects will be more oriented towards ecological/habitat related goals and others more oriented towards human dimensions goals. Furthermore, an individual restoration project may have several stated goals, reflecting the multiple functions performed by healthy coastal ecosystems and the multiple social values connected to or resulting from those functions. The ecological and human dimensions goals of coastal restoration are often closely interconnected. The term **ecosystem services** describes the full range of goods and services provided by natural ecological systems that cumulatively function as fundamental life-support for the planet (Costanza et al. 1997). Since ecosystem services are critical to human welfare and survival, many ecological goals/objectives associated with habitat restoration can be readily restated as social or economic goals/objectives. For example, the ecological goal of increasing primary productivity may be an effective way to achieve the human dimensions goal of reducing property damage in coastal areas (through reduced wave energy and erosion potential). Likewise, the ecological goal of enhancing fish breeding and nursery grounds will likely advance the human dimensions goal of increasing fishery yields.

Ecological and human dimensions goals of coastal restoration may not always, however, be compatible with one another. For example, the human dimensions goal of increasing opportunities for coastal recreation and tourism may, beyond some threshold level of use, be incompatible with the ecological goal of improving water quality. Similarly, two or more human dimensions goals may not be compatible with each other. An example of this would be the goal of improving aesthetic values in the form of viewsheds and scenic vistas versus the goal of enhancing access to restored coastal resources in the form of roads, parking lots, and boat ramps. Restoration practitioners, locally affected

Figure 5. Two or more human dimensions goals may not be compatible…boat marinas in the distance compete with pristine kayak routes in Orcas Island Marina, San Juan Islands, Washington State. Photo courtesy of James Mason.

Coastal Ecosystem Services

The life-support functions performed by ecosystem services can be divided into two groups: production functions (i.e., goods) and processing and regulation functions (i.e., services). Costanza et al. (1997) estimated the economic value of ecosystem services for the entire biosphere to be in the range of $16-54 trillion per year, with an average of $33 trillion per year. More than one-third of this amount ($12.6 trillion) was attributed to functions performed by coastal ecosystems. By comparison the global gross national product (GNP) is somewhere around $18 trillion per year. While these are considered fairly rough estimates, they nonetheless highlight the economic value of ecosystem services. Since ecosystem services are often not quantified in terms comparable with economic services and manufactured capital, they are often devalued by policymakers.

Production functions of coastal ecosystems include:

- Food production (e.g., fish, shellfish, waterfowl)
- Raw materials (e.g., timber, harvestable grasses, peat)
- Genetic resources (e.g., medicines, commercial products)

Processing and regulation functions include

- Disturbance regulation (e.g., storm protection, flood control, drought recovery, and erosion control)
- Climate regulation (e.g., greenhouse gas regulation)
- Regulation and supply of water for drinking, irrigation and industry (groundwater recharge and discharge)
- Waste treatment and pollution control
- Nutrient cycling (removal, retention, and transformation)
- Habitat for plants and animals

communities, and coastal resource managers will need to explicitly identify trade-offs and carefully consider value priorities amongst a range of competing, and often contentious goals and objectives. When considering these trade-offs it is important to keep in mind the following definition of restoration:

> *"The process of reestablishing a self-sustaining habitat that in time can come to closely resemble a natural condition in terms of structure and function"* (Turner and Streever 2002).

Thus, human uses of restored coastal habitats that are unsustainable would not be considered appropriate goals or objectives of coastal restoration projects. In general, goals and objectives based on human mutual and non-use values associated with coastal habitats will be more compatible with ecological goals than those based on human dominant values. However, consumption-oriented objectives (e.g., increase recreational and commercial fishery harvests) are not necessarily inconsistent with ecological goals or with the definition of restoration if such uses are managed in a wise and sustainable manner.

In addition to identifying the desired human dimensions outcomes or anticipated benefits of proposed projects, coastal restoration practitioners should also consider **environmental equity**, or how those benefits will be distributed throughout the affected community. The following questions regarding environmental equity should be addressed:

- Will the project be designed to benefit a relatively small number of individuals over a limited geographic area or will the benefits be more evenly dispersed throughout the population?
- Will the anticipated benefits have regional or national significance, either as a stand-alone project or as part of a network of similar restoration projects?
- In terms of **environmental justice** concerns, how will the proposed project affect the

distribution of environmental quality among people of different racial, ethnic or socio-economic groups?

Related to environmental equity is the concept of **intergenerational equity**, which focuses on the temporal distribution of project impacts (both positive and negative) across generations. Some intergenerational equity questions that might be raised for coastal restoration projects are:

- How will the anticipated benefits and costs be distributed over time and across generations?
- Are the anticipated project benefits stated as short-term or long-term goals?
- If goals are short-term, are there any long-term negative impacts associated with these goals that might be passed on to future generations?
- If goals are long-term, are there any short-term negative impacts associated with these goals that will be absorbed by the current generation?

Another factor to consider in terms of selecting human dimensions goals/objectives of coastal restoration projects is the probability of achieving those goals/objectives. While success is never guaranteed due to unpredictable and uncontrollable social and environmental factors, some desired outcomes or anticipated human dimensions benefits clearly will be more within the locus of control of the practitioner than others. In general, human dimensions goals and objectives that are more directly linked to desired ecological outcomes (e.g., improve water quality, reduce flooding) will have a higher probability of success than those with many intervening factors (e.g., improve tourism, improve commercial fishing). For purposes of project evaluation, coastal restoration practitioners may find it helpful to rank human dimensions goals and objectives by relative probability or likelihood of success (e.g., low, medium, and high).

Difficulties associated with monitoring project success and attributing measurable parameters to particular goals and objectives are discussed in the next section.

ISSUES IN MONITORING MEASURABLE PARAMETERS

Establishing a Baseline

In order to monitor changes in human dimensions parameters over time, it is necessary to first establish a baseline or starting point against which future measures can be compared. Appropriate baseline data may or may not be available depending on the particular goals and measurable parameters to be monitored. If baseline data are not available, restoration practitioners will need to design a plan for collecting and analyzing human dimensions information prior to implementation of restoration activities. If baseline human dimensions data do exist, it will be important to determine whether or not the data are available at the geographic level required for your project. For example, results reported at a state, regional or sub-regional level will be of little use for monitoring impacts of local restoration projects. Another factor that should be considered when using existing data is the frequency and timeliness of the available data. That is, when was the data last collected and is the data collected regularly (e.g., annually, every five years) or was it a one-time effort (See **Cross-sectional** versus **Longitudinal Studies** box below). Human dimensions data collected frequently at regular intervals will be more useful for restoration monitoring than one-time or sporadic data collection efforts.

In some cases it may be feasible to access "raw data" (i.e., data that are not analyzed/summarized) and conduct a specific project analysis at the desired level of detail. If such

Cross-sectional versus Longitudinal Studies
(Source: Babbie 1989)

In the social sciences, cross-sectional research refers to studies that investigate some phenomenon by taking a cross section (i.e., snapshot) of it at one time and analyzing that cross section carefully. By comparison, longitudinal studies are designed to permit observations over an extended period of time. There are three types of longitudinal studies: (1) **trend studies**, those that study changes within some general population over time, (2) **cohort studies**, those that examine more specific subpopulations or cohorts (e.g. age groups) over time, and (3) **panel studies**, those that study the same set of people over time. While longitudinal studies are generally more costly and time consuming, they are often advantageous for monitoring changes in measurable parameters over time.

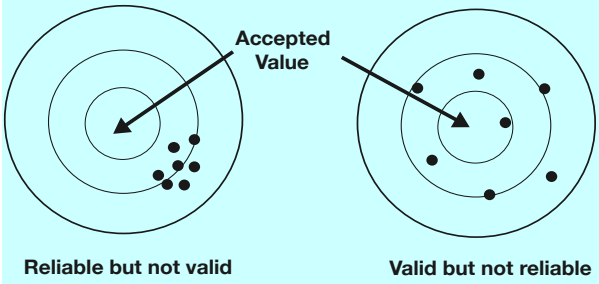
an analysis is necessary, it is recommended that you consult with an expert who is familiar with the database and other statistical issues that may arise. Some existing data sources (i.e., **secondary data**) and research methods that might be useful in monitoring particular human dimensions goals and objectives are provided in the next section.

Project Scale Issues

Coastal restoration efforts can range in size from local projects covering just a few acres to entire watersheds covering thousands of acres. In addition to spatial scale diversity, restoration projects will vary in terms of cost, labor involved, type of activity, and level of activity intensity, among others. The size and scope of a restoration project can influence the choice of project goals and should be considered when designing a human dimensions monitoring plan. Certain human dimensions goals will be nearly impossible to evaluate for smaller projects because of the difficulties associated with monitoring measurable parameters. Monitoring some measurable parameters may simply be too costly or time consuming for small-scale projects to undertake. Even if such sampling is conducted, depending on the sampling effort expended, the results may be too imprecise or inaccurate as to be useful in any practical sense. Regardless of project size and scale, practitioners should keep both **reliability** and **validity** in mind when monitoring human dimensions goals and objectives of coastal restoration projects (see **Reliability** and **Validity** box below).

Another factor to consider when conducting social science assessments is **causality**, i.e., to what extent one event is caused by the other. For the purposes of coastal restoration monitoring it is important to understand the cause and effect relationship between the restoration project and the parameter you are measuring. The section below (and accompanying matrix in Appendix I) describes several suggested measurable parameters that might be effective for monitoring particular human dimensions goals. However, the strength of the causal relationship between the restoration effort and any observed change in the measurable parameter will be project specific. That is, the influence of other factors (causes) on the observed effect will vary

Reliability and Validity
(Source: Babbie 1989)



In statistical terms, reliability refers to the likelihood that a given measurement procedure or technique will yield the same result each time that measure is repeated (i.e., reproducibility of the result; consistency of a measuring instrument). Validity, on the other hand, refers to how close to a true or accepted value a measurement lies (i.e., the degree to which a measuring instrument measures what it is supposed to measure). While it is not often possible to know what the true value is, it is possible to identify factors that reduce accuracy such as instrument error or measurement error.

project by project. Caution should be used when attributing post-restoration changes in human dimensions parameters to the restoration project. Restoration practitioners should assess and, to the extent possible, quantify the influence of all other factors to determine the proportion of the observed changes attributable to the restoration project. Causality should be considered in the restoration monitoring planning stage to strengthen cause and effect relationships and minimize the probability of reaching an erroneous conclusion.

While causality is an issue for all project monitoring regardless of scale, in general, causality will be more difficult to establish for small-scale restoration projects than for larger projects (project scale issue). For example, restoring 25 acres of wetlands may have a positive impact on both commercial fishing and eco-tourism. However, the actual impact, measured in fishery yields and tourist expenditures, may be very small in relation to all the other factors affecting these parameters (e.g., fishing regulations, weather, the economy, gas prices). Low causality combined with random variation could make it very difficult to conclude, with any degree of confidence, that the restoration project did, in fact, have a positive impact on these goals.

Larger restoration projects are also susceptible to extraneous factors that may influence the parameters measured. However, on a larger scale, parameter estimates will generally be more precise and the probability of reaching an erroneous conclusion regarding causality should be greatly reduced. Whenever possible, smaller individual restoration projects should be linked or networked together as part of a restoration monitoring program for an entire estuary, watershed, region or some other appropriate geographic level. Networking restoration efforts allows the goals of small community projects to be connected to some larger regional plan, and will also facilitate **adaptive management**. Monitoring and project evaluation can then be conducted using a tiered approach with several different management levels (e.g., individual project, community, estuary). Examples of this approach are the San Francisco Bay and Galveston Bay Restoration Plans. The matrix in Appendix I indicates which measurable parameters restoration practitioners should be able to monitor regardless of project size or scope (indicated by a closed circle ●), and which measurable parameters may be possible to monitor for some individual or small-scale projects but in other instances monitoring such parameters may only be feasible at the restoration program level (i.e., estuary, watershed, etc.). These circles are intended to provide only broad general guidance, and exceptions may exist for any given restoration project. Practitioners are encouraged to consult with human dimensions experts (see Appendix IV) and carefully evaluate the feasibility of monitoring any of these parameters for their particular project.

Ethical Guidelines in Conducting Social Science Research

Ethical guidelines should always be considered when conducting social science research that involves human subjects. Webster's New World Dictionary defines ethical as "conforming to the standards of conduct of a given profession or group." Within the social sciences, different professional associations have codified their own ethical rules for researchers in that particular discipline to adhere to. Ethical issues arise from the kinds of research questions social scientists investigate and the methods they use to obtain information about people's thoughts and behaviors (Frankfort-Nachmias and Nachmias 1992). Social science research often involves an intrusion into people's lives, disrupts their regular activities, and takes up their time and energy. Surveys may ask sensitive questions (e.g., income, age) that respondents may not feel entirely comfortable answering. This section briefly describes some of the basic

tenets of research ethics that apply to most of the social sciences. There are rules that one must abide by. However, rules, standards, and exceptions vary according to discipline and research methodology employed. It is strongly recommended that restoration practitioners review the code of ethics for the particular type of research they are conducting and consult with an expert prior to implementing a social science research design.

One ethical guideline is that social science research should be voluntary. No one should be forced or coerced into participating in a survey, focus group, interview, or other data collection method. Participants should know that they can refuse to participate and that they can terminate involvement at any time. A related ethical criterion in social research is **informed consent**. Informed consent emphasizes the importance of both accurately informing research participants as to the nature of the research and obtaining their verbal or written consent to participate (Babbie 1989). The purpose, procedures, data collection methods and potential risks (both physical and psychological) should be clearly explained to participants without any deception.

Another important ethical tenet is the right to privacy defined as "the freedom of the individual to pick and choose for himself the time and circumstances under which, and most importantly, the extent to which, his attitudes, beliefs, behavior, and opinions are to be shared with or withheld from others" (Ruebhausen and Brim 1966, *in* Frankfort-Nachmias and Nachmias 1992). Issues of privacy in social research can arise over the sensitivity of information collected, the setting in which it is collected, and the dissemination of the information. Two common approaches to protect the privacy of participants are anonymity and confidentiality (Frankfort-Nachmias and Nachmias 1992). A respondent is considered anonymous when the researcher cannot identify a given response with a given respondent. Anonymity can be assured by separating the identity of individuals (e.g., name, social security number, phone number) from the information they give. One way to assure anonymity is simply not to collect any identifying information (Frankfort-Nachmias and Nachmias 1992). If complete anonymity cannot be guaranteed, researchers should at least assure participants that the information they provide will be kept confidential – i.e., an individual's information will not be revealed to the public. Data can still be presented in aggregate form as long as individual responses cannot be linked to a particular person. One technique to increase confidentiality is to link identifying variables to the person's information in the database using a code number. Both identifiers and code numbers should be destroyed once data analysis is completed.

Ethics and Social Science Research Key Elements:

- Voluntary
- Informed Consent
- Privacy
- Anonymity
- Confidentiality

DISCUSSION OF SPECIFIC GOALS, OBJECTIVES, AND MEASURABLE PARAMETERS

The diverse values people derive from healthy functioning coastal ecosystems can be expressed within one of ten main goal categories shown below. The goals discussed below are not intended to be mutually exclusive or completely independent of one another. In some cases, as mentioned previously, goals may be conflicting, in other cases two or more of these goals will be complementary (e.g., protecting historic/ cultural values and enhancing access in coastal areas will likely improve tourism and general market activity). Nor is the list intended to be exhaustive, or for all goals to apply to all restoration projects. There may well be additional goals not identified here that would be appropriate and specific to a given project, and that should be included. Similarly, there are certain to be goals that just wouldn't apply to any number of restoration projects and therefore should not be included in a plan. Each of the currently identified goals is described in more detail below, along with related objectives and measurable parameters. Suggested social science research methods, techniques and available data sources to monitor these parameters are also provided. If a goal is appropriate for a particular project, practitioners can then determine if a coastal restoration project meets its intended human dimensions goals and associated objectives.

HUMAN DIMENSIONS GOALS OF COASTAL RESTORATION

Additional sources of information (references and web sites) are provided at the end of each goal category section and in the annotated bibliography at the end of this chapter. These sources are intended to provide the reader with a starting point for researching this topic, not as a comprehensive list. Since many other sources relevant to your particular project needs may exist, and new research is conducted every day, we recommend that practitioners conduct their own literature review and consult with human dimensions experts before developing and implementing a monitoring plan.

The matrix in Appendix I indicates measurable parameters to monitor for each of the specific human dimensions goals shown. This matrix is the product of a recent workshop titled *Monitoring the Human Dimension Aspects of Coastal Restoration* (see box about the workshop below). It is intended to help restoration practitioners identify potential human dimensions goals and measurable parameters typically connected to coastal restoration projects. However, this list is not necessarily exhaustive, and other goals and parameters (not shown here) may also be appropriate for any given project. Since each restoration project is different, the optimum

parameters to measure will depend on the specifics of your project. When choosing among measurable parameters, consideration should be given to **content validity**. Content validity is based on the extent to which a measurement (i.e., parameter) reflects the specific intended domain of content (i.e., stated goal and objective). That is, how well does the parameter measure whether or not a particular project goal has been met. It is also important to keep in mind that while some parmeters, on their own, may not serve as very good indicators of goal attainment, when used in combination with other parameters they may be very useful. Measuring multiple, often related, parameters for a particular goal (or objective) can help validate your measurement and strengthen your conclusions regarding goal attainment.

Workshop on Monitoring the Human Dimension Aspects of Coastal Restoration:

In April, 2004 over 40 experts convened for three days to discuss human dimensions goals, objectives, and monitoring of coastal restoration projects. This workshop was sponsored by The Program for the Human Dimensions of Marine and Coastal Ecosystems, a collaboration between The University of Massachusetts-Amherst, Department of Natural Resources Conservation, Human Dimensions Research Unit and NOAA's National Ocean Service. Professionals with diverse human dimensions and coastal restoration expertise and backgrounds (e.g., sociology, cultural anthropology, resource economics, geography, recreation and tourism, fisheries management etc.) came from all over the United States to participate. Participants included representatives from government agencies, non-governmental organizations (NGOs), and over 15 universities. This workshop was an important first step in identifying the human dimension aspects of coastal restoration and formulating a systematic approach to addressing those aspects.

Coastal Recreation, Tourism and Access Goals (see matrix Appendix I):

- Increase the number of recreational opportunities
- Increase the level of recreation activity
- Increase the quality of recreational opportunities
- Improve tourism and ecotourism
- Enhance access to coastal resources

COASTAL RECREATION, TOURISM, AND ACCESS

Goals and Objectives

The use of coastal areas for recreation and tourism in the Unites States has increased dramatically in recent years. More than one-half of all Americans visit a coastal area each year and coastal recreation and tourism are critically important for the U.S. economy. People flock to coastal areas to participate in a variety of recreational activities, most of which are either dependent upon or greatly enhanced by healthy functioning coastal ecosystems.

Figure 6. Kayaking along the Patuxent River, Chesapeake Bay, Maryland. Photo by Mary Hollinger, NODC biologist, NOAA, from the NOAA Photo Library. http://www.photolib.noaa.gov/coastline/line2034.htm

Healthy ecosystems are the attraction to which people are often drawn. The creation of opportunities for coastal recreation and tourism, via a healthy ecosystem, can result in a number of positive social and economic impacts including the creation of jobs, an increased tax base, increased local household incomes and improved infrastructure. However, depending on the activity type, style, participants' modes of conduct, and use level allowed, many forms of coastal recreation and tourism can be detrimental to the very ecosystems they depend upon. Therefore, coastal restoration practitioners need to consider whether or not project goals associated with recreation, tourism and access will conflict with other project goals or undermine the restoration effort as a whole. Some forms of coastal recreation are more "eco-friendly" than others and therefore are more compatible with ecological restoration goals. Similarly, certain types of tourism and

Figure 7. Recreational angler fishing for striped bass (Chesapeake Bay, MD). Photo by Ronald Salz, NOAA NMFS, Silver Spring, MD.

Figure 8. Sailboats racing in America's Cup off Newport, Rhode Island. Photo by Commander John Bortniak, NOAA Corps. From the NOAA Photo Library. http://www.photolib.noaa.gov/corps/corp1728.htm

Coastal Recreation and Tourism in the U.S.: Selected Facts and Figures

(Sources: Leeworthy and Wiley 2001; Restore America's Estuaries 2002; NOAA International Year of the Ocean web site).

- In the U.S., about 89 million people (age 16 and older) participate in some form of marine recreation each year
- Beaches are the number one tourist destination in the U.S.
- An estimated 21 million people (age 16 or older) participate in saltwater fishing each year
- Recreational saltwater fishing creates over $6.6 billion in wages and an estimated 288,000 jobs annually (USDI and USDC 1997)
- Nearly 11 million people (age 16 or older) participate in snorkeling or SCUBA diving each year
- Over 31 million people (age 16 or older) participate in coastal viewing activities such as bird watching, other wildlife, and viewing or photographing scenery

Selected Coastal Recreation Activities

Visit beaches	Personal watercraft
Fishing	Wind surfing
Water-skiing	SCUBA diving
Visit waterside	Canoeing
Motorboating	Waterfowl hunting
Bird watching	Surfing
Viewing other wildlife	Kayaking
Swimming	Rowing
Sailing	Viewing scenery
Snorkeling	Photography

recreation will be more compatible with the human dimensions goals of enhancing and protecting aesthetic, historic and cultural values in coastal areas than will other types of tourism and recreation. Coastal stakeholders will need to decide what type of coastal ecosystem they want when assessing the appropriateness of restoration goals related to recreation, tourism and coastal access.

Recreational goals associated with coastal restoration can be categorized into three main types: (1) increase the level of recreation activity, (2) increase the number of recreational opportunities, and (3) increase the quality of recreational opportunities. Specific objectives under the goal 'increase level of recreation activity'[3] may be to increase the number of annual recreation visitor days (**RVDs**) in any one or several of the coastal recreation activities shown above. Other objectives connected to this goal would be to increase economic activity and jobs in various outdoor recreation sectors.

Conflict, in outdoor recreation, is defined as behavior of an individual or group that is incompatible with the social, psychological, or physical goals of another person or group (Manning 1999). **Outdoor recreation conflict** can occur between persons engaged in the same activity, in different recreational activities (e.g., jet-skis and anglers), or between recreationists and other non-recreation users (e.g., commercial fishermen and anglers). **Crowding** is a form of conflict that is based on an individual's judgment of what is appropriate in a particular recreation activity and setting. Use level is not interpreted negatively as crowding until it is perceived to interfere with one's objectives or values. Besides use level, factors that can influence perceptions of crowding include participant's motivations, expectations, and experience related to the activity, and characteristics of those encountered such as group size, behavior, and mode of travel (e.g., motorized versus non-motorized) (Manning 1999). While many other factors are involved, in general, as use level increases the potential for conflict and crowding in outdoor recreation settings will increase as well.

Another potential recreation-related goal is to increase the number of recreational opportunities in coastal environments[3]. If opportunities for coastal recreation increase at a faster rate than use level, this goal may actually reduce conflict and crowding by dispersing participants over a larger area. Objectives related to this goal include:

Figure 9. Beaches provide multiple recreational opportunities including sunbathing, swimming, sailing, and parasailing (Lauderdale by the Sea, FL). Photo by Ralph F. Kresge, NOAA Corps Collection, from the NOAA Photo Library.

[3] See "Coastal Recreation, Tourism, and Access Related Goals" in Appendix I.

- Add or improve recreation facilities (e.g., coastal parks, nature centers, marinas, boat ramps, trails, toilets)
- Add access points
- Increase the number of commercial providers (e.g., charterboats, eco-tourism outfitters, guides)
- Reduce the number of beach closures, shellfish area closures and finfish consumption advisories

The third type of recreational goal is aimed at improving the quality of recreational opportunities[4] available in coastal areas. One objective related to this goal could be to increase user satisfaction for any number of recreational activities. Satisfaction in outdoor recreation is defined as the difference between desired and achieved goals (Manning 1999). Since conflict is goal interference attributed to another's behavior, reducing perceptions of conflict (and crowding) will likely increase satisfaction ratings. People typically have multiple goals or motivations for engaging in a particular activity and many outdoor recreation motivations are not activity-specific. For example, anglers often cite motivations not related to actually catching fish (e.g., for relaxation, to be outdoors, to share experiences with friends and family) as being more important than catch-related motivations (e.g., the excitement of the catch, to catch a trophy fish) (Salz et al. 2001). Quality of recreational opportunities might be increased by focusing on catch-related indicators (e.g., catch/harvest rates, average fish size, number of trophy fish caught), reducing fish/shellfish advisories and closures, reducing beach closures, or improving aesthetics of the recreational experience (e.g., scenery and viewscapes) and other nonactivity-specific components.

Because coastal recreation and tourism are so closely interconnected, many of the specific objectives (discussed above) associated with increasing the level, number and quality of recreational opportunities would also apply to the goal of improving tourism[4] in general. People who are attracted to coastal destinations for recreation will also spend money on food, lodging, souvenirs, gifts, gas and other items that benefit the tourism industry. In addition to recreation, people visit coastal areas to learn about and appreciate maritime history, culture, folklore and traditional ways of life. Enhancing these opportunities may be identified as an

Figure 10. Having fun at the beach, Beach havaen, New Jersey (1930). Photo by Mr. Benton Hickok, America's Coastlines Collection, from the NOAA Photo Library. http://www.photolib.noaa.gov/coastline/line1753.htm

Figure 11. Sign for public beach access. Photo courtesy of NOAA Coastal Services Center web site.

[4] See "Coastal Recreation, Tourism, and Access Related Goals" in Appendix I.

objective if a connection can be made between the restoration project and this type of coastal tourism.

Closely related to recreation and tourism goals of coastal recreation is the goal of enhancing access to coastal resources. In order to take advantage of the many coastal recreation and tourism opportunities that exist, people must have access to coastal habitats[4]. Increasing opportunities for access to coastal areas of recreational, historical, aesthetic, ecological, or cultural value is cited as a high priority under the federal Coastal Zone Management Act. When discussing coastal access it is important to make the distinction between private access and public access. Commercial, residential and industrial development (and associated infrastructure) along the coast continues to increase as the number of people visiting and moving to coastal areas increases. Privatization of coastal lands limits the public's perpendicular access to the coast (see Figure 12). Lateral access along the coast is a public right protected by the Public Trust Doctrine. Under the common law Public Trust Doctrine submerged lands and water below the mean high water mark (in most states), are held in trust by the states for public use and enjoyment (e.g., fishing, shellfishing, boating, walking) (Coastal States Organization 2000).

Many of the objectives associated with enhancing coastal access are similar to those for increasing the number and level of recreational opportunities (discussed above; also see Appendix I). Access may also be enhanced for commercial uses such as commercial fishing. Coastal restoration projects can enhance access through the physical functions of healthy coastal ecosystems including shoreline stabilization, erosion control, flood control, and sediment retention. These natural functions may also preclude the need for hard structural shoreline stabilization solutions (e.g., jetties, breakwaters, and seawalls) which can not only impede access but may also be dangerous to beach users.

Similar to increasing coastal recreation, the goal of enhancing access as part of a coastal restoration project is a double-sided issue. While there are many associated social and economic benefits, public access to coastal resources may also have detrimental effects on native plants, animals, and geographic features of restored habitats (NOAA Coastal Recreation and Tourism website). For restoration efforts oriented towards ecosystem benefits, rather

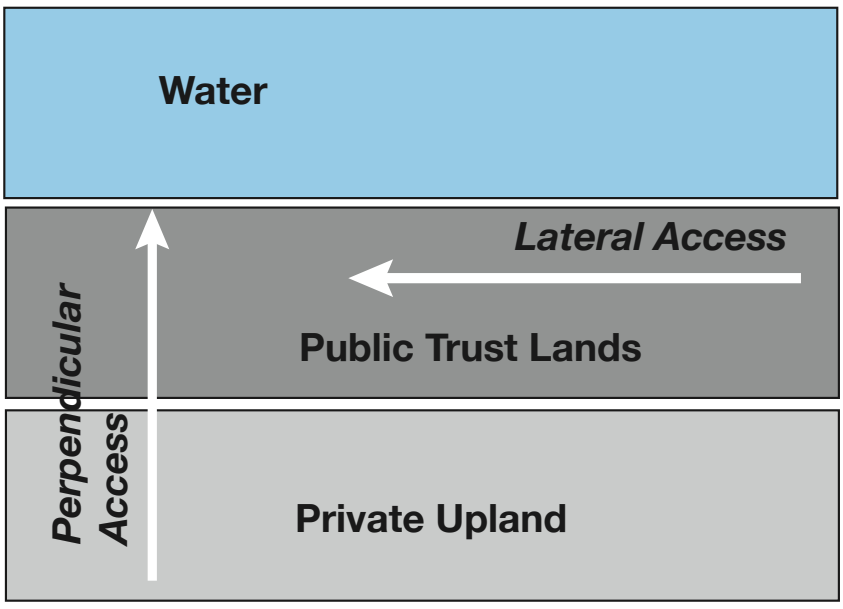


Figure 12. An illustration explaining the difference between lateral access and perpendicular access in coastal areas.

than human dimensions benefits, one of the goals may be to reduce access in order to protect sensitive ecological features or species at risk. If, however, enhancing access is a goal of restoration, practitioners need to consider ways to plan for and accommodate associated human impacts while protecting the natural environment. Strategies that might be employed include:

- Gates and buffers placed around sensitive areas
- Public education about erosion impacts, litter, and wildlife disturbance
- Signage to indicate paths and discharge improper behavior
- Regulations with fines and penalties for improper behavior (NOAA Coastal Recreation and Tourism website)

Monitoring Measurable Parameters

Measurable parameters for recreation, tourism, and access related goals of coastal restoration are listed in Appendix I. Suggested methods and existing data sources that may be helpful in monitoring these parameters can be found here. Additional sources of information (web sites and general references) are also provided.

Survey Research

Monitoring many of the parameters related to recreation goals and objectives will involve collecting information from the recreation participants themselves. These include both cognitive variables (e.g., perceptions of conflict and crowding, and user satisfaction) and behavioral variables (e.g., economic expenditures, number, size and species of fish caught, and activity avidity). Some of this information may already be collected by various federal and state natural resource agencies, universities and non-governmental organizations (see references below and Appendix II). Since this list is not exhaustive, it is recommended that you contact federal, state, and local agencies in your project area for more information on existing human dimensions data sources. Many of these existing data sources may be more useful for program level monitoring as results are typically summarized over a wide geographic area. If existing data are not available to monitor recreation/tourism related goals at the spatial scale required for an individual project, practitioners may decide to conduct their own data collection.

Survey research is the administration of questionnaires to a sample of respondents selected from some defined population (Babbie 1989). This research method is widely used in the social sciences and is especially suited for making descriptive studies of large populations. Space does not allow for a thorough discussion of social science survey research methods here. Instead, we provide a general overview of the topic and direct the reader to additional sources of information that may be useful in designing and implementing survey research.

Types of Survey Error
(Source: Salant and Dillman 1994)

- **Coverage Error** – occurs when the list – or frame – from which a sample is drawn does not include all elements of the population that researchers wish to study
- **Sampling Error** – occurs when researchers survey only a subset or sample of all people in the population instead of conducting a census
- **Measurement Error** – occurs when a respondent's answer to a given question is inaccurate, imprecise, or cannot be compared to other respondent's answers
- **Nonresponse Error** – occurs when a significant proportion of the survey sample do not respond to the questionnaire and are different from those who do in a way that is important to the study

Earlier in this chapter we introduced the statistical terms reliability and validity (see side box, page 14.10). Anyone conducting survey research should be aware of the different sources of error that can affect the reliability or validity of survey results. While survey error can never be completely eliminated, through early identification of potential sources, survey researchers may be able to minimize this error in the design and implementation phases of the study. The four types of error researchers need to be aware of are described in the box below. Please refer to the additional readings for more detailed discussion of reliability, validity, and ways to minimize errors in survey research.

Three major survey research methods are used to elicit information from respondents: the mail questionnaire, the personal interview, and the telephone survey (Frankfort-Nachmias and Nachmias 1992). Hybrids and combinations of these three basic approaches are also used. For example, an on-site interview may be conducted to collect names, addresses, and/or phone numbers of willing participants for a follow-up mail or telephone survey. Drop-off surveys involve surveyers going door-to-door to personally deliver questionnaires to households or businesses. Another variant is the windshield survey where questionnaires, along with a self-addressed stamped envelope, are placed on car windshields at strategic locations (e.g., boat launch site, beach parking lot). Deciding which survey method is best suited for your particular research objectives may depend on a number of factors. These include:

- Study topic – quantity, type, complexity and sensitivity of questions asked
- Survey population – availability of phone number and/or addresses, anticipated response rates, demographics (e.g., age, ethnicity, income)
- Money – amount budgeted and facilities available for interviewing
- People – number and experience of available staff and survey expertise of researchers
- Time – how much time you have to produce results

Each of the three major survey types (mail, personal, telephone) has different advantages and disadvantages associated with them. These are listed and briefly explained below under factors to consider when selecting a survey method. For a more complete discussion of each survey type please refer to the survey research references provided at the end of this section.

Another important step in survey research is selecting a sample. A **sample**, as defined in this context, is a set of respondents selected from a larger population for the purpose of a survey (Salant and Dillman 1994). Sample surveys are powerful in that they allow one to describe the characteristics of an entire population based on relatively few respondents. Sampling may not be necessary for small study populations where you attempt to survey all individuals or households in your target population. However, for most survey research, sampling is an efficient way to save time and money while still collecting high quality statistical information.

If you decide that sampling is necessary for your restoration monitoring plan, you need to identify the **target population**, consider if you need a population list, and select the sample (Salant and Dillman 1994). The **population list** is the list from which the sample is drawn. Population lists can come from many different sources and there are many kinds of lists such as telephone directories, club membership, landowners property tax lists, and license holders (e.g., hunting, fishing, shellfishing). Population lists may not always be necessary as in the case of random-digit dialing telephone surveys or with personal on-site interviews (e.g., you identify all the boat launch sites in the study area and then randomly select boaters to interview at those

Factors to Consider When Selecting a Survey Method
(Sources: Salant and Dillman 1994; Frankfort-Nachmias and Nachmias 1992; Babbie 1989)

- **Cost** – mail surveys are generally less expensive than telephone surveys. Both mail and telephone surveys allow for wide geographic contact at minimal cost. Personal interviews are typically the most costly method.
- **Staff expertise / training** - since they are self-administered, mail questionnaires do not require trained interviewers. Both telephone and personal interviews require trained interviewers.
- **Interviewer-respondent interaction bias** – self-administered mail surveys eliminate bias that may result from the personal characteristics of interviewers, variability in their skills or the tendency for respondents to give answers they think the interviewer wants to hear. Potential for this kind of bias is greater with personal interviews than telephone interviews.
- **Privacy and anonymity** – it is easier for respondents to answer personal or sensitive questions in writing at home (i.e., mail survey) than to a stranger on the phone or an interviewer in public
- **Considered answers and consultations** – mail questionnaires are preferable when questions demand a considered (rather than immediate) answer or if answers require consulting personal documents or other people
- **Noncoverage error** – lists of names, addresses or phone numbers are sometimes difficult to obtain and are almost never complete. Telephone surveys can avoid the problem of unlisted numbers by using random-digit dialing.
- **Nonresponse error** – some people are less likely to respond to a mailed questionnaire than others. Those interested in the topic are more likely to respond while those who cannot read or understand the questions are unlikely to respond. Item nonresponse may also be an issue if respondents skip over difficult or boring questions. Nonresponse can also be a problem with telephone surveys as people may resent the intrusion of being called at home. Other people may screen their calls or may be difficult to contact on the phone. Response rates for personal interviews are typically higher than either mail or telephone surveys.
- **Question complexity** – for mail surveys, questions must be straightforward enough to understand solely based on printed instructions. No opportunity exists for verbal clarification or for probing to clarify ambiguous answers, as does with personal or telephone interviewing. Mail questionnaires and personal interviews can include maps, tables, and graphical aides that cannot be shown over the telephone.
- **Control of interview situation** – with mail surveys the researcher has no control over who fills out the survey and cannot know for sure if the intended respondent answered the questions. Control of interview situation is highest for personal interviews and lowest for mail surveys.
- **Speed** – in general, telephone surveys produce faster results than either mail surveys or personal interviews. With computer-assisted telephone interviewing (CATI) data collection and data entry are combined into one step as respondent's answers are directly entered into the database.

sites). Once you have identified your target population and a population list (if necessary) you are ready to select the sample. Sample designs range from very basic **simple random sampling** to more complicated approaches involving multiple stages, **systematic sampling** intervals, **stratification**, **weighting,** and **clustering**. Space does not allow for adequate discussion of survey sampling designs here. For more information refer to the references at the end of this section. It is also recommended that you consult with a survey research expert to determine the survey design best suited for your monitoring effort.

Additional sources and survey research experts should also be consulted when designing a questionnaire for coastal restoration monitoring. Questionnaires should be designed to minimize measurement error and close attention should

be paid to the exact wording, order, layout, and complexity of survey questions and instructions. Some issues to consider are (Salant and Dillman 1994):

- Do the questions contain emotional or biased words?
- How specific are the questions and what level of specificity is desired?
- Are respondents able to answer the questions?
- Are respondents willing to provide the information?

Practitioners may also want to consider using a **focus group** to assist in survey questionnaire design (see box below on focus groups). It is also strongly recommended that you pre-test your questionnaire on a sub-sample of the target population in order to identify and minimize any potential sources of error prior to full survey implementation.

Monitoring Facilities and Accessibility

Monitoring parameters related to recreation facilities and accessibility at the project level is fairly straightforward. For individual projects, an inventory can be kept to track changes over time in the number of marinas, boat slips, boat ramps, trail miles, commercial providers, and infrastructure development that are the direct result of the restored habitat. However, it may not be possible to link increased demand for coastal recreation facilities and infrastructure to improved water quality or ecosystem health within one small geographic area. Rather, changes in these parameters are more likely to result from the cumulative effect of many restoration projects rather than any one individual project. Therefore, these parameters may provide a better measure of recreation, tourism, and access goals if they are monitored at the program level (e.g., estuary, watershed, state).

Focus Groups

Focus groups are sometimes used to provide a head start on knowing which questions to ask in a survey. A focus group is a small group of people (i.e., 8 to 12) that are brought together by a moderator to discuss their opinions on a list of predetermined issues. Focus groups are designed to collect very detailed information on a limited number of topics. This data collection method can provide valuable insights into how and why people feel, think, and talk about an issue the way they do (NOAA Coastal Services Center, Human Dimensions of Coastal Management web site). Focus groups can be used either in conjunction with survey research or to help support findings of other methods. They are also occasionally used in a limited context as the primary data collection method for researching oral histories.

The number of new access points (both private and public) created by an individual restoration project can be monitored by practitioners through observation. Changes in the number of coastal access points can also be monitored at the program level. Most coastal states keep a detailed inventory of access points available to the public. It is recommended that you consult the appropriate state and local agencies and chambers of commerce in your project area to determine what data on coastal recreation facilities and access are available if you plan to monitor these parameters.

Outdoor Recreation and Tourism General References

- Honey, M. 1998. Ecotourism and Sustainable Development. Island Press, Washington, D.C.
- Manning, R. E. 1999. Studies in Outdoor Recreation: A Review and Synthesis of the Social Science Literature in Outdoor Recreation, 2nd ed. Oregon State University Press, Corvallis, OR.
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study of Massachusetts' marine recreational fisheries. National Oceanic and Atmospheric Administration, Technical Memorandum, NMFS-NE-165. http://www.nefsc.noaa.gov/nefsc/publications/tm/tm165/

- Wood, M. E. 2002. Ecotourism: Principles, Practices & Policies for Sustainability. The International Ecotourism Society, Burlington, VT.
- Weaver, D. 2000. The Encyclopedia of Ecotourism. CABI Publishing, Oxon, UK.

Coastal Recreation, Tourism and Access Web Sites

- 1998 Year of the Ocean Coastal Tourism and Recreation Paper: http://www.yoto98.noaa.gov/yoto/meeting/tour_rec_316.html
- Developing Naturally: An Exploratory Process for Nature-Based Tourism, Clemson University: http://www.strom.clemson.edu/publications/Potts/DevNatbook.pdf
- Effectiveness of State Programs in Providing Public Access to the Shore, NOAA Office of Ocean and Coastal Resource Management: http://www.ocrm.nos.noaa.gov/czm/czmeffectiveness.html
- Environmental Impact Reduction Checklist for Recreation and Tourism, U.S. Environmental Protection Agency: http://es.epa.gov/oeca/ofa/pollprev/tour.html
- Environmental Implications of the Tourism Industry, Resources for the Future: http://www.rff.org/CFDOCS/disc_papers/PDF_files/0014.pdf
- Factors Related to Recreational Boating Participation in the U.S., Responsive Management: http://www.rbff.org/pressroom/Factors-Boatingreport.pdf
- Guidance for Best Management Practices For Caribbean Coastal Tourism, Island Resources Foundation: http://www.irf.org/ir_bmp.html
- Guidelines for Monitoring and Detecting Visitor Impacts, Sustainable Ecosystems Institute: http://www.sei.org/bulletin.html
- Nature-based Tourism, U.S. EPA, Office of Sustainable Ecosystems and Communities: http://www.epa.gov/ecocommunity/tools/econatt5.pdf
- NOAA Coastal Services Center Coastal Recreation and Tourism web site: http://www.csc.noaa.gov/techniques/recreation/index.html
- Oregon Sea Grant's Coastal Recreation and Tourism Pages: http://seagrant.oregonstate.edu/crt/
- Providing Public Access in Coastal Areas: Options for Landowners, Great Lakes Sea Grant Network: http://www.msue.msu.edu/imp/modtd/33840311.html
- Recreational Boating and Fishing Foundation Sponsored Research web site: http://www.rbff.org/research/
- Social, Environmental, and Economic Impact Analyses for Tourism, Western Rural Development Center: http://extension.usu.edu/wrdc/ctah/section9.html

Survey Research Methods - Some Suggested Readings

- Babbie, E. 1989. The Practice of Social Research. Wadsworth Publishing Company, Belmont, CA.
- Beimer, Paul. 1991. Measurement Errors in Surveys. John Wiley & Sons, New York, NY.
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- Fowler, Floyd J., Jr. 1993. Survey Research Methods, 2nd ed. Sage Publications, Newbury Park, CA.
- Frankfort-Nachmias, C. and D. Nachmias. 1992. Research Methods in the Social

Figure 13. Community volunteers plant a salt marsh plant. *Spartina alterniflora*, at the Eastern Neck National Wildlife Refuge on Eastern Neck Island, Maryland. Photo courtesy of NOAA Restoration Center. http://www.photolib.noaa.gov/habrest/r0006500.htm

Sciences, 4th ed. St. Martin's Press, New York, NY.

- Krueger, R. A. 1994. Focus Groups: A Practical Guide for Applied Research. Sage Publications, Thousand Oaks, CA.
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ENHANCE COMMUNITY INVESTMENT

Goals and Objectives

Coastal restoration efforts are increasing throughout the United States and many of these projects are undertaken with the support of local residents, interest groups, and government agencies. However, some restoration efforts have resulted in public resistance and conflicts between stakeholders with different views on whether and how ecological restoration of public trust resources should proceed (Vining et al. 2000). Restoration and maintenance of healthy coastal habitats will require the long-term support of a broad cross-section of the public, and particularly support from the local community where the restoration takes place (Restore America's Estuaries 2002). Local stewardship and investment (i.e., buy-in) will facilitate long-term conservation and success of restoration sites. Community buy-in should also ensure that policies and social norms designed to protect restored habitats are self-enforced. Therefore, an important human dimensions goal of coastal restoration projects is to enhance community investment. Investment, in this context, is broadly defined and can include the allocation of resources (people, time, money, equipment, facilities), policy changes, or psychological investment (attitude change).

Before considering the different ways community investment in coastal restoration can be enhanced, it is important to first define community. One definition of community is

Figure 14. A student posing with planting equipment. Palmetto Estuary, Manatee County, Florida. Photo credit: Mark Sramek, NOAA Restoration Center, SE region, from the NOAA Photo Library. http://www.photolib.noaa.gov/habrest/r0022918.htm

a group of people who interact socially, have common history or other ties, meet each other's needs, share similar values, and often share physical space (U.S. EPA 2002). Another way to define community is as a "place" shaped by either natural boundaries (e.g., watershed), political or administrative boundaries (e.g., city, neighborhood), or physical infrastructure (U.S. EPA2002). Thus, a comprehensive understanding of the multi-faceted concept *community* should incorporate both a *sense of community* as described in the first definition and a *sense of place* as described in the second definition. For a detailed discussion on community definition and identification of community characteristics relevant to coastal restoration monitoring refer to the EPA document - Community Culture and the Environment: A Guide to Understanding a Sense of Place.

One important objective within the overall goal of enhancing community investment is to increase volunteerism in coastal restoration activities. Volunteers are often an essential component for the success of restoration projects. People have different, and often multiple, motivations for volunteering in ecological restoration efforts including helping the environment, exploration and learning, spiritual enhancement, social interactions, and self-esteem (Grese et al. 2000). To meet this objective, practitioners should create opportunities for community members to participate in the implementation, maintenance, and monitoring phases of coastal restoration projects (Restore America's Estuaries 2002). People who live and work within the immediate vicinity of a restoration site can be alert to natural and anthropogenic changes in restored ecosystems. Volunteers can bolster community support, reduce project costs and bring energy and enthusiasm to restoration efforts (US EPA and NOAA). Good sources for volunteers include non-profit environmental groups, schools, public community service groups, and private service groups organized by local corporations. While volunteerism is encouraged, it is imperative that volunteers are properly trained and supervised in order to maintain the scientific integrity of your restoration project (Vining et al. 2000). For more information on volunteerism please refer to the web site given in the box on Volunteering for the Coast.

Volunteering for the Coast

www.csc.noaa.gov/techniques/volunteer/index.html

Volunteering for the Coast is a web site for anyone interested in environmental stewardship through personal actions. The information provided on this site is for individuals looking for volunteer opportunities, coordinating volunteer efforts, or seeking ways to build successful volunteer programs.

In addition to their many other benefits, coastal restoration projects may strengthen community members' sense of community and sense of place. By fostering collaborations and increased communications, restoration projects can bring individuals and groups within the community closer to one another and break down some of the social barriers that might have previously existed. One of the most effective ways to

Figure 15. Replanting marsh grass in an effort to protect and rebuild this beach near Annapolis, Maryland. Photo credit: Mary Hollinger, NODC biologist, NOAA, from the NOAA Photo Library. http://www.photolib.noaa.gov/coastline/line2326.htm

build trust among community members is to start with small restoration projects that have immediate visible results that all stakeholders can measure and contribute to. The elements of trust, reciprocity, and community cohesion are all captured in the term **social capital**. Social capital describes the internal social and cultural coherence of society, the norms and values that govern interactions among people and the institutions in which they are embedded. Social capital is the glue that holds societies together and without which there can be no economic growth or human well-being. Thus, enhancing community investment in coastal restoration is linked to enhancing social capital within the community.

Other specific objectives associated with the goal of enhancing community investment in coastal restoration include:

- Increase the extent to which restoration projects are accepted and encouraged within the local political structure (e.g., town meetings and community master plans)
- Increase the interest, involvement and buy-in of locally run non-governmental organizations (NGOs) and local businesses in restoration efforts
- Increase community members awareness and knowledge of, and appreciation for coastal restoration

Monitoring Measurable Parameters

There are several parameters that can be measured to monitor the goal of enhancing community investment. Volunteerism can be measured by counting the number of volunteers or number of volunteer hours devoted to a restoration project. These variables can be measured at all stages of the restoration project including planning, funding, implementation, maintenance, and monitoring. Basic demographic information (e.g., age, gender, occupation, zip code, ethnicity) can be solicited from volunteers to determine involvement levels according to town/neighborhood, ethnic group, socioeconomic group, or age group. If community investment is a stated goal of your restoration project, such information may be used to target groups that appear to be less invested. Another indicator of community investment is the activity level of non-governmental organizations (NGOs) or non-profits associated with a restoration project. This activity can be initiated by small, local NGOs and grassroots groups or by local chapters of larger organizations (e.g., Sierra Club, Audubon Society). Some communities may find it beneficial to form an NGO around a particular coastal restoration project. NGO activity can be measured in terms of inputs or resources expended (e.g., time, people, energy, money) or in terms of outputs (e.g., web sites, educational materials) directly related to the restoration effort.

Sponsorship of a restoration project by local corporations can also be an indicator of community investment. The National Corporate Wetlands Restoration Partnership (CWRP) is a public-private partnership between the federal government, state governments, and private corporations to restore wetlands and other aquatic habitats. The CWRP's objective is to protect, enhance, and restore wetlands and other aquatic habitats by partnering to leverage the collective resources, skills, and processes of the private and public sectors. For more information see their web site at: http://www.coastalamerica.gov/text/cwrp.html.

Community investment may also be measured by the extent to which coastal restoration is accepted and encouraged within the local political structure. Specific parameters that can be monitored include whether or not a restoration project is part of the community master plan (both short-term and long-term planning) and how often it comes up at official town meetings and other political forums. Attendance at town meetings when the restoration project is

on the agenda may be an indicator of general interest in restoration, although not necessarily community buy-in or investment. Town policies such as zoning changes and tax incentives that are related to coastal restoration and a town's monetary contribution (i.e., portion of cost sharing) towards a coastal restoration effort may also be indicative of community investment.

Community investment in coastal restoration can also be measured by the attitudes and behaviors of community members. One measurable parameter is the extent to which locals use the restored coastal areas. Another indicator is the level of community communications related to coastal restoration such as local newspaper articles, newsletters, radio programs, and local television news segments. Surveys, personal interviews, focus groups, and voting behavior can also be used to measure community members' attitudes (i.e., psychological investment) towards coastal restoration projects. Some other social science research methods used for community assessment are shown in the table below.

Community Investment and Volunteering Web Sites

- Community Engagement and Volunteerism - A wealth of tools for school administrators, teachers, parent/family volunteers, and others who coordinate volunteer and community partnership activities between schools and other organizations, including businesses. http://www.tenet.edu/volunteer/main.html
- Concerned Citizens - Provides information on how you, your family, and your community can protect the environment. http://www.epa.gov/epahome/citizen.htm
- Healthy Communities Programs - Descriptions of services, training, and technical assistance offered by the National Civic League, including stakeholder analysis, visioning, assets mapping, facilitation, etc. http://www.ncl.org/cs/services/healthycommunities.html
- Managing Volunteer Programs - An overview of many volunteer management issues, from insurance to supervision techniques to assessing volunteer management practices. http://www.mapnp.org/library/staffing/outsrcng/volnteer/volnteer.htm
- Monitoring Water Quality - Provides information and guidance for volunteer water quality monitoring. http://www.epa.gov/owow/monitoring/vol.html
- National Park Service Volunteer Guidelines - Although the primary purpose of this document is to assist National Park Service volunteer coordinators in the management of their respective programs, this publication has also been a good resource for many

Community Assessment Research Methods (Source: U.S. EPA, Community Culture and the Environment: A Guide to Understanding a Sense of Place, 2002)

Method	Description
Asset Mapping	A graphical representation of a community's capacities and assets.
Cognitive Mapping	A method used to collect qualitative data and gain insight into how community members perceive their community and surrounding natural environment.
Concept Mapping	A method that collects data about how community members perceive the causes or related factors of particular issues, topics, and problems.
Social Network Mapping	A method used to collect, analyze, and graphically represent data that describe patterns of communication and relationships within a community.

private volunteer organizations. http://www.nps.gov/volunteer/vipguide.htm

- Volunteer Estuary Modeling – An Environmental Protection Agency manual with information and methodologies for volunteer efforts aimed at monitoring estuarine water quality. http://www.epa.gov/owow/estuaries/monitor/
- Volunteer Today: The Electronic Gazette for Volunteerism – An e-newsletter designed to 1) build the capacity of individuals to organize effective volunteer programs, and 2) enhance the profession of volunteer management. http://www.volunteertoday.com/
- Watershed Restoration: A Guide for Citizen Involvement – NOAA document providing information on how citizens can improve their watersheds. http://www.cop.noaa.gov/pubs/das/das8.html

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Figure 16. A group of boy scouts and their leaders plant native wetland plants in Palmetto, Manatee County, Florida. Photo credit: Peter Clark, Tampa bay Watch, from the NOAA Photo Library.

Protection: A Citizen's handbook for Protecting Ecosystems and Communities. EPA 230-B-96-003. Office of Policy, Planning and Evaluation, Washington, D.C.

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ENHANCE EDUCATIONAL OPPORTUNITIES

"Human needs and aspirations the world over can only be satisfied as environmental awareness leads to appropriate action at all levels of society…Appropriate action requires a solid base of sound information and technical skills. But action also depends upon motivation which depends upon widespread understanding, and that, in turn, depends upon education."

- Mostafa K. Tolba (former Director) United Nations Environment Program

"Successful restoration requires an informed public willing to support the policies, funding, and lifestyle changes necessary to maintain healthy and productive ecosystems."

- Quoted from Restore America's Estuaries: A National Strategy to Restore Coastal and Estuarine Habitat (2002)

Goals and Objectives

Coastal restoration projects provide educational opportunities for increasing people's awareness, understanding and appreciation of coastal habitats, ecosystem functions, and nature in general. Opportunities may also be created to conduct research and educate the public on the human dimensions benefits associated with restoration. Outreach and education can be incorporated into coastal restoration projects at

all stages (i.e., planning, implementation, and monitoring) as both the process and the outcome can enhance educational opportunities. Specific objectives within this goal include:

- Increase opportunities for formal education: exposure of K-12 students to environmental education through classroom activities and field trips, teacher training and knowledge base, curriculum development
- Increase opportunities for informal education: hands-on learning, brochures, television and radio public service announcements, newspaper articles and editorials, posters, informational kiosks, web sites (including text, pictures, real-time video and virtual tours of restored areas), workshops, public forums
- Increase opportunities in academia: undergraduate and graduate student learning and training, research projects, academic publications, journal articles, seminars, workshops, and poster sessions
- Increase opportunities for experiential education: interpretive centers and programs, interpretive signage, and guided eco-tours

Public school educational programs connected with a coastal restoration project can include:

Figure 17. Coastal habitats provide many unique and exciting educational opportunities for students of all ages. Photo from the NOAA Photo Library.

- An assessment of student perceptions, attitudes and knowledge about coastal habitats and restoration efforts
- Identification of how learning goals can be made compatible with student learning potential
- Identification of how subject matter exercises can be introduced at restoration project sites and in the classroom, and
- Assessment of how communication links can be established with other schools and learning facilities (e.g., museums, nature centers) to extend the learning chain (Nordstrom 2003)

The use of restoration project sites to promote educational goals can be accomplished through both active (e.g., on-site tours, lectures, and programs conducted by specialists) and passive (e.g., posting signs for tourists passing the area) learning techniques (Nordstrom 2003). It is important that posters and signs describing coastal restoration projects are designed for interpretive rather than solely scientific value, and are presented at the appropriate comprehension level using common terms, simple story lines, colorful word pictures, and bold graphics (Hose 1998).

Monitoring Measurable Parameters

In order to monitor measurable parameters associated with enhancing educational opportunities, restoration practitioners will need to contact the various schools, universities and colleges, museums, media outlets, nature centers and other educational sources in the area that may be involved with coastal habitat education. Counts of the number of interpretive centers and programs, research projects, students and teachers trained, school field trips, classroom activities, and guided eco-tours should be readily attainable from these sources. Similarly, the number of opportunities for informal education (see above) related to a restoration project

can also be quantified. However, in assessing whether or not particular educational goals (or objectives) have been met, it is important to establish a clear connection between the restoration project and any observed increase in these educational activities. For example, an elementary school may be developing a curriculum on wetlands that is independent of a local wetlands restoration project. It is, therefore, recommended that coastal restoration practitioners be proactive in advancing their educational goals by contacting schools, universities and local media and developing creative ways to turn restoration projects into educational opportunities.

PROTECT OR IMPROVE HUMAN HEALTH

Goals and Objectives

An important human dimensions goal of coastal restoration is to protect and improve human health. Healthy coastal ecosystems perform many ecological services and life-supporting functions (e.g., pollution removal, water filtration, flood protection) that are critical to our health and survival. When these ecosystems become degraded human health and safety are jeopardized. The Estuary Restoration Act of 2000 clearly states that priority should be given to restoration projects that "promote human health and safety and the quality of life for individuals and families." Specific objectives under the general goal of promoting human health and safety include:

- Reduce the number of health advisories for fish, shellfish, and waterfowl consumption
- Reduce the number and duration of shellfish area closures
- Reduce the number of drinking water health advisories
- Increase the level of compliance with federal and state water quality standards
- Reduce the number, area, and duration of beach closures
- Reduce the incidence of disease related to seafood consumption and water-borne illnesses
- Reduce biotoxin levels and the number, area, and duration of harmful algal blooms (HABs)
- Reduce the number of hypoxia events

Toxic substances, such as metals (e.g., mercury and lead) and toxic organic chemicals (e.g., PCBs and dioxin) that originate from industrial discharges, runoff from city streets, mining activities, runoff from landfills, atmospheric deposition, and a variety of other sources, can severely disrupt the nearshore waters habitat. These toxic substances can cause death or reproductive failure in the fish, shellfish, and

Figure 18. One human dimensions goal of coastal restoration is to increase the number of "swimable and fishable" bodies of water. Photo courtesy of the County of Orange, California web site.

wildlife that use the habitat. In addition, they can accumulate in animal and fish tissue (leading to fish consumption advisories), become attached to sediments, or find their way into drinking water supplies, posing long-term health risks to humans. Pesticides and herbicides used on farmlands and lawns can be washed into ground and surface waters by rainfall, snowmelt, and irrigation practices and may, ultimately, find their way to nearshore waters. These contaminants are usually very persistent in the environment and can accumulate in fish, shellfish, and wildlife to levels that pose a risk to human health and the environment. Restored wetlands can reduce these risks by filtering toxics and other pollutants out of the system before they can bio-accumulate or contaminate drinking water supplies.

A condition known as *hypoxia,* or oxygen depletion, occurs primarily during the summer in over half of the major estuaries in the United States (Rabalais 1998). Its duration and extent range from a few weeks and limited areas to several months and expansive areas. Human activities such as changes in land use and nutrient enrichment increase the likelihood of this phenomenon. Increases in nutrient inputs clearly and directly relate to population density in watersheds draining to coastal areas. Population-driven increases in nutrient loading are causing problems in the form of oxygen depletion, habitat loss, fish kills, and increasing the frequency and duration of harmful algal blooms (Rabalais 1998). Since coastal wetlands (and other habitat types) naturally reduce nutrient loading to receiving waters, reducing the number of hypoxia events in a particular body of water may be an objective of coastal restoration.

Human beings are exposed principally to the naturally occurring toxins produced by harmful algal blooms (HABs) through the consumption of contaminated seafood products which can result in illness and even death. Many scientists have suggested that increases in HABs are somehow linked to increased pollution of coastal habitats. Therefore, coastal restoration efforts may be an effective management tool for protecting human health from HABs. The most significant public health problems caused by harmful algae are: Amnesic Shellfish Poisoning, Ciguatera Fish Poisoning, Diarrhetic Shellfish Poisoning, Neurotoxic Shellfish Poisoning, Paralytic Shellfish Poisoning, and Pfiesteria (see box below). Each of these syndromes is caused by different species of toxic algae which occur in various coastal waters of the United States and throughout the world. For more information on these syndromes go to the Woods Hole Oceanographic Institute Harmful Algae Page web site at: http://www.whoi.edu/redtide/illness/illness.html

Public health protection is a shared responsibility between federal, state, and local agencies and Native American tribes. This responsibility includes informing citizens of the possible health hazards associated with eating chemically contaminated fish, shellfish, and waterfowl from contaminated waters. This is done through consumption advisories that are issued for particular water bodies and species,

Fish Kills in Chesapeake Bay

During the 1990's, massive fish kills occurred in estuaries in North Carolina and Delaware and in the Chesapeake Bay and its tributaries. Watermen working in the area of the kills experienced flu-like symptoms, rashes, and memory loss. The kills and associated fish ulcers have been linked to conditions related to excess nutrients, including low oxygen levels and blooms of toxic algae and infectious disease agents. Excess nutrients are introduced into estuarine systems through changes in water management and land use throughout the watershed. Some forms of restoration, as well as changes in regional management approaches, can help to alleviate this problem and enhance human health and enjoyment in this region. Source: NOAA web site "Harmful Algal Blooms" http://www.hab.nos.noaa.gov/pfiesteriafacts.html

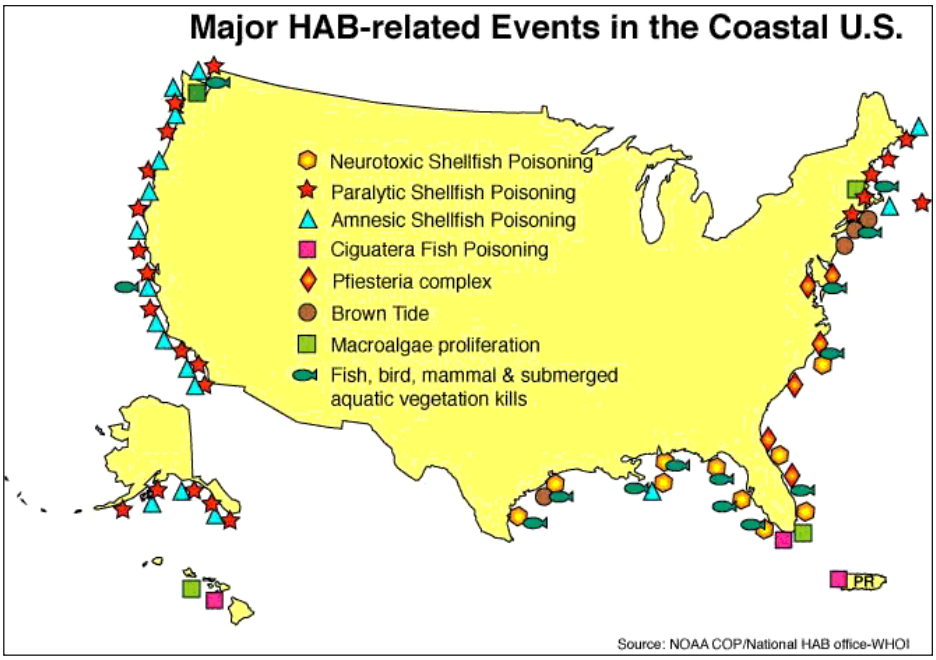

Figure 19. Major HAB-related events in the coastal U.S. as of 2004. Photo courtesy of U.S. National Office for Marine Biotoxins and Harmful Algae Blooms, Woods Hole Oceanographic Institution, Woods Hole, MA.

and can apply to either the general population or specific vulnerable subpopulations such as pregnant women or children.

Human health is also protected by beach and shellfish area closures generally issued by state or local natural resource agencies. Pathogens are microorganisms such as bacteria and viruses that can cause human health problems. These organisms enter water bodies from sources such as inadequately treated effluent from sewage treatment plants, storm water drains, faulty septic systems, medical waste, runoff from livestock pens, and boats that discharge untreated or poorly treated sewage. When found at unsafe levels in nearshore waters, pathogens can lead to beach and shellfish bed closures. Shellfish area closures are generally based on state and national water quality standards. Unlike consumption advisories, which are merely suggestive, shellfish area closures are legally enforced and persons found poaching shellfish in closed areas can be fined or imprisoned. Conditional harvesting programs allow the shellfish digger to take shellfish from areas that are usually classified as uncertified or closed. During periods of little or no rainfall, when non-point source runoff is not carrying high levels of bacteria and other contaminants into these areas, water quality improves to the point where it meets the high standards for certified shellfishing areas.

Officials at the state and local level make public health decisions about beach closings. The Beaches Environmental Assessment and Coastal Health (BEACH) Act of 2000 requires each state and territory with coastal recreation waters to adopt health-based bacteria standards that are "as protective of human health" as EPA's 1986 criteria for bacteria. Federal grants are provided to states for beach monitoring and public notification programs, technical guidance, scientific studies, and Federal water quality standards to backstop state and territorial efforts where necessary.

Coastal restoration projects may also help achieve the human health objectives related to drinking water quality. The EPA's Office of Ground Water and Drinking Water (OGWDW), together with states, tribes, and its many partners, protects public health by ensuring safe drinking water and protecting ground water. OGWDW, along with EPA's ten regional drinking water programs, oversees implementation of the Safe

Drinking Water Act, which is the national law safeguarding tap water in America. For more information about ground water and drinking water quality go to the EPA web site at: http://www.epa.gov/OGWDW/

In addition to protecting us from disease and illness, healthy coastal ecosystems can also promote mental health. There are many psychological benefits associated with recreating and working in healthy environments that can be enhanced by coastal restoration efforts. Clean, healthy ecosystems have been linked to the promotion of community welfare and social capital and the reduction of crime in some areas. Coastal restoration also promotes the physiological benefits associated with certain types of coastal recreation such as hiking, kayaking, or swimming.

Monitoring Measurable Parameters

As with other human dimensions coastal restoration goals, program level monitoring on a large geographic scale (e.g., entire estuary or watershed) may be required to evaluate some of the measurable parameters associated with human health. Shellfish advisories and area closures may, in some cases, be localized enough to allow for project level monitoring of this parameter. Depending on the restoration project, parameters related to drinking water quality might also be measured at the individual project level. Due to the migratory nature of many fish species, fish advisories often cover a wide geographic area. Therefore, it will be very difficult, if not impossible, to attribute changes in recommended fish consumption levels over time to an individual restoration project. Data on incidence of shellfish consumption diseases and water-borne illnesses, hypoxia events, and HABs may not be available at the geographic scale required for individual project level monitoring. Even if such data are available (or collected by the restoration practitioner) at the desired scale, it may still be difficult to establish a direct causal link between a particular restoration effort and a change in any of these parameters over time. Many other factors can affect these variables, particularly when measured on a small geographic scale.

Existing data sources from various federal, state, local, and Tribal authorities are available for many of the health-related parameters restoration practitioners may want to measure. Environmental and natural resource agencies in coastal states routinely collect information on hypoxia events and harmful algal blooms (HABs) that may be of use for coastal restoration monitoring. Many universities also conduct research on HAB outbreaks that may be used to monitor changes in the number, area, and duration of HABs over time. To find out more about available HAB data in your project state visit the NOAA Coastal Services Center Harmful Algal Bloom Project web site at: http://www.csc.noaa.gov/crs/habf/resources.html

The National Listing of Fish and Wildlife Advisories (NLFWA) describes health advisories issued by the federal government, states, territories, tribes, and local governments. Restoration practitioners can use the NLFWA to get information on nearly 2,800 advisories in the United States at http://www.epa.gov/waterscience/fish/. Information provided for each advisory includes:

- Species and size of fish or wildlife under advisory
- Chemical contaminants covered by the advisory
- Location and surface area of the waterbody under advisory
- Population subject to the advisory
- Local contacts (including names, phone numbers, and websites)

The NLFWA web site can be used to generate national, regional, state, or local maps that illustrate advisory information. For monitoring

restoration parameters related to human health, it is also recommended that you contact the local, state, or tribal health advisory representative in your project area. http://map1.epa.gov/scripts/.esrimap?name=Listing&Cmd=StContacts

EPA has developed a Beach Advisory and Closing Online Notification system (BEACON) to make state beach advisory and closing data available to the public. In BEACON, each beach is geographically displayed on a map that links the beach to data. Restoration practitioners can select a beach and view the available data for that beach by either choosing a state and county or typing the beach name. Information provided for each beach includes contact information, monitoring and notification program information, general beach characteristics, advisories and closings, and location data. For more information or to use the BEACON system go to: http://oaspub.epa.gov/beacon/beacon_national_page.main

Every community water supplier must provide an annual report (sometimes called a consumer confidence report) to its customers. The report provides information on local drinking water quality, including the water's source, the contaminants found in the water, and how consumers can get involved in protecting drinking water. For many areas these reports can be accessed online at EPA's Local Drinking Water Information web site (http://www.epa.gov/safewater/dwinfo.htm). This site contains detailed information that restoration practitioners may be able to use in monitoring changes in water quality over time. It is also recommended that you contact local water suppliers and state and local health officials for additional information.

In addition to state and local health agencies, the federal Centers for Disease Control and Prevention (CDC) is another good source of existing information on the incidence of disease and illness. CDC is recognized as the lead federal agency for protecting the health and safety of people. Within CDC, the National Center for Health Statistics is the agency responsible for monitoring the health status of the population. For more information visit their web site at: http://www.cdc.gov/nchs/about.htm.

Hypoxia, Harmful Algal Bloom and Fish Toxicity Web Sites

- NOAA National Centers for Coastal Ocean Science, Harmful Algal Blooms web site: http://www.cop.noaa.gov/Fact_Sheets/HAB.html
- NOAA Coastal Services Center Harmful Algal Bloom Project web site: http://www.csc.noaa.gov/crs/habf/resources.html
- National Office for Marine Biotoxins and Harmful Algal Blooms - Woods Hole Oceanographic, The Harmful Algae Page: http://www.whoi.edu/redtide/

Hypoxia, Harmful Algal Bloom and Fish Toxicity References

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PROTECT TRADITIONAL, CULTURAL, AND HISTORIC VALUES

Goals and Objectives

Culture is in many ways shaped, defined, and adapted based on one's surrounding natural environment (see box below for definition of culture). Environmental conditions and available resources can determine such things as the kinds of available food, materials from which clothing, tools, and shelters can be fashioned, and the cycle of human activities necessary for survival (Taylor 1992). Coastal regions of the U.S. are rich in cultural traditions and history that are intricately connected with the coastal resources found in those areas. Many people's

Definition of Culture
(Source: Parker and King 1998)

Culture is a system of behaviors, values, ideologies, and social arrangements. These features, in addition to tools and expressive elements such as graphic arts, help humans interpret their universe as well as deal with features of their environments, both natural and social. Culture is learned, transmitted in a social context, and modifiable. Synonyms for culture include lifeways, customs, traditions, social practices, and folkways. The terms folk culture and folklife might be used to describe aspects of the system that are unwritten, learned without formal instruction, and deal with expressive elements such as dance, song, music, and graphic arts as well as storytelling.

Figure 20. The Fishermen's Memorial at Gloucester, Massachusetts commemorating the thousands of fishermen who have lost their lives from this port. Photo by Nance S. Trueworthy, from the NOAA Photo Library. http://www.photolib.noaa.gov/fish/fish0990.htm

Cultural Diversity in Coastal Louisiana
(Source: Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority 1998)

Coastal Louisiana's residents represent a diversity of nationalities and cultures, including French, Spanish, Portuguese, German, Italian, English, Caribbean, Croatian, African, and American Indian. The largest and oldest immigrant group to colonize the wetlands is of French descent. New Orleans was founded by Bienville in 1718. Exiled Acadians from what is now Nova Scotia, Canada, began moving into the region beginning in the 1750's. All immigrants to Louisiana's wetland landscapes developed cultural practices tied to the annual-use cycle that is still linked to the region's natural resource base. Traditionally, thousands of coastal residents have been engaged in farming, hunting, trapping, shrimping, crabbing, oystering, and fishing.

cultural identity and integrity are dependent upon healthy coastal ecosystems (see box on the cultural diversity in coastal Louisiana). Some examples include the lobstermen of Maine, the Chesapeake Bay watermen, Louisiana Cajuns, and the Makah Tribe in the Pacific Northwest. Therefore, a potential goal of coastal restoration is to protect the traditional, cultural and historic values associated with the coastal resources we are attempting to restore.

Many coastal communities and indigenous peoples can trace their heritage of living off the land and sea back many generations. Traditional uses and practices associated with coastal resources are often consumptive in nature (e.g., fishing, hunting, gathering). The term "**subsistence**" is used to describe customary and traditional uses of renewable resources (i.e., food, shelter, clothing, fuel) for direct personal/family consumption, sharing with other community members, or for barter. Subsistence communities are often held together by patterns of natural resource production, distribution, exchange, and consumption which help maintain a complex web of social relations involving authority, respect, wealth, obligation, status, power, and security. Values associated with subsistence lifestyles include hard work, self-sufficiency, independence, reciprocity, trust, close-knit communities, and kinship networks.

Coastal resources can also be important for spiritual, religious, and ceremonial uses and for the continuity of maritime customs, traditions, folklore, and myth. Traditional uses might also

Figure 21. Eskimo woman and child ice fishing in the Bering Sea. Photo obtained from NOAA Photo Library. http://www.photolib.noaa.gov/fish/fish1363.htm

Figure 22. A prayer for calm seas, the Blessing of the Fleet is held on the Fourth of July in Kodiak Island, Alaska. Reverend Archimandrite Innocent (on the right) and the Reverend Sergios Gerken, at left, sprinkle holy water. Their Russian Orthodox faith arrived in 1784, when traders started Russia's first colony in North America. Photo courtesy of George F. Mobley, National Geographic Magazine, November 1993.

The Blessing of the Fleet, Stonington Connecticut

This annual event celebrates the cultural heritage and way of life of the fishing community of southeastern Connecticut, and is a way to honor those who have lost their lives at sea. "The Blessing" is a community celebration that reflects Portuguese culture and the Portuguese traditions of many of the fishermen. The festivities include a parade through town, and the actual blessing of the boats when the regional Bishop blesses the boats as they pass by in procession. A memorial wreath with a symbolic broken anchor is thrown overboard in honor of those fishermen who have been lost at sea. Similar "Blessing of the Fleet" events take place in fishing communities throughout the country.

include long-term or periodic use of an area for social events and community gatherings. For members of these communities, the value of protecting their traditional way of life is, of course, tremendous. However, cultural and historic values associated with coastal communities are also widely appreciated and valued by people outside those communities as well. For example, many people who visit or reside in fishing villages enjoy watching the commercial fishing boats, learning about local maritime history, and derive satisfaction from knowing that such traditional lifestyles still exist. Maritime festivals and other traditional social gatherings in coastal communities often attract tourists, providing coastal regions with additional economic benefits. In addition to historic and traditional use values associated with coastal resources, certain species of plants and animals also contain cultural symbolic value. These values are expressed through official state designations (i.e., the state fish or the state bird), wildlife license plate sales, and the purchase of fish and wildlife related merchandise.

People often impart special meaning to natural resources and hold certain place-based attachments to particular natural settings. Many of us reminisce about the way things used to be and have fond memories of childhood coastal experiences (e.g., fishing with a grandparent, collecting shells on the beach) that we hope to pass along to our children and grandchildren. Thus, coastal restoration may also protect the values associated with family traditions that are dependent upon healthy coastal environments.

Monitoring Measurable Parameters

The study of *culture* is the subject of investigation by specialists in several disciplines including anthropology, archaeology, ethnography, cultural geography, folklore, history, historic preservation, and sociology (Taylor 1992). Each of these disciplines studies culture from a different perspective and uses different techniques and methodologies for the collection and analysis of data (Taylor 1992) (see box on page 14.39 on interviewing). For more information on researching and documenting cultural values, please refer to the references

Interviewing
(Source: Taylor 1992)

Interviewing is an efficient technique for gathering data and the one most often used by many cultural specialists. When a fieldworker conducts an interview, he or she must determine the amount of control to be applied. A non-directed (or non-structured) interview encourages discussion of a wide range of topics that are largely determined by the interests of the informant. A directed (structured) interview is usually characterized by the interviewer's attention to very specific topics and questions. Sometimes the interviewer may change the approach. For example, an interviewer might switch from a directed to a non-directed approach if it becomes evident that an informant's storehouse of traditional knowledge presents an unusual opportunity for the documentation of many general aspects of local culture. Data elicited during interviews can be recorded in writing in the form of fieldnotes, or as answers to questions on a questionnaire. They can also be recorded verbatim on audiotape with a tape recorder, or recorded both aurally and visually on videotape with a video camera and sound unit. In the case of interviews recorded on audio or videotape, it is proper to ask the informant to sign a consent form in order to establish that he or she has given permission for the use of information on the tape. The text of the form should specify as accurately as possible where the tape recording will be deposited and how it may be used. If the informant wishes to place restrictions on the use of the recording, these restrictions should be written on the form.

and web sites provided at the end of this section. It is also recommended that you consult with an expert in one of the fields listed above before attempting to monitor these parameters.

While documenting maritime culture within a community or project area is possible, establishing a causal link between an individual restoration project and the protection of those cultural, historic and traditional use values may prove far more difficult. Although maritime cultural traditions are greatly dependent upon healthy coastal ecosystems, many other social, economic, and environmental factors will likely determine whether or not those traditions will continue and survive. Linking coastal restoration to the preservation of cultural values may also be difficult because the cultural benefits associated with restored ecosystems may be both spatially and temporally far removed. For example, restoring a marsh may enhance the nursery and breeding grounds of commercially valuable fish. However, since the mature stocks of fishes are usually geographically far removed from the marsh nursery, the cultural benefits may accrue to some geographically distant fishing village. It may also take several years before commercial fishery yields show any sign of increase, during which time many other confounding environmental social, economic, and regulatory changes may take place. Given these difficulties, monitoring the goal of protecting cultural and historic values is, in most cases, more feasible at the program level (or for very large individual restoration efforts). That is, the cumulative effect of many individual restoration projects throughout a watershed, estuary, or region may help to protect maritime cultural values and this effect may be measurable on a large spatial and temporal scale. Still, individual restoration

Figure 23. Makah Tribal members of the Pacific Northwest paddling traditional hollowed out red cedar canoes. Photo from the Makah Cultural and Research Center web site.

projects may be directly linked to particular cultural events and gatherings. An example would be a community "clam bake" that is made possible by the improved water quality resulting from a local restoration effort.

Traditional, Cultural, and Historic Values Web Sites

- American Folklife Center, Library of Congress: http://www.loc.gov/folklife/
- Cultural Resources Information on the Internet - Annotated descriptions of agencies and organizations with programs in cultural resources. http://www.nrcs.usda.gov/technical/cultural.html
- Indiana University, Oral History Research Center. http://www.indiana.edu/~ohrc/index.html
- Utah State University, Oral History Program. http://www.usu.edu/~oralhist/oh.html

Traditional, Cultural, and Historic Values References

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ENHANCE NON-MARKET VALUES AND IMPROVE AESTHETIC VALUES

Goals and Objectives

In economics, the term value refers to the price individuals are willing to pay in order to obtain a good or service. Traditional market goods and services are supplied by private firms and bought by consumers who pay market prices for them (NOAA 1995). However, for some goods and services no traditional market exists whereby suppliers and consumers agree on a price. These are cumulatively referred to as **non-market goods and services**. Restoration of coastal habitats can enhance the value of non-market goods and services.

Figure 24. The Great Egret is a common species seen in the lagoons of Mar Negro (Jobos Bay National Estuarine Research Reserve, Puerto Rico. Photo from the NOAA Photo Library. http://www.photolib.noaa.gov/nerr/nerr0506.htm.

Non-market economic values are often divided into two main categories: **direct use values** and **non-use values**. Direct use value refers to the set of values derived from any direct use of natural environments including for recreation, ecosystem services, or aesthetic enjoyment. Many of the ecosystem services provided by healthy coastal habitats (e.g., flood protection, nutrient cycling, pollution reduction, nursery grounds) cannot be valued using traditional market-based approaches. Coastal restoration projects may also enhance aesthetic values, a non-market good associated with our appreciation for beauty in nature (plants, animals, scenic landscapes, seascapes, viewsheds, etc.). A specific objective may be to increase the acres of land preserved or open space within a given community. Many recreational values associated with coastal habitats (e.g., fishing, wildlife viewing, beach use) are also considered non-market values since they are not traded in a traditional market (see section on page 14.14 on Coastal Recreation, Tourism, and Access).

Non-use values are values not associated with current use and include such "non-uses" as maintaining the option to personally use part of the natural environment in the future (**option value**), leaving part of the natural environment

for others to use in the future (**bequest value**), and the knowledge that part of the natural environment will continue to exist even if the individual holding this value never contemplates using it (**existence value**). Specific restoration project objectives under the goal of enhancing non-market values could be to increase any one or combination of these direct use or non-use social values.

Many people believe that natural environments also possess intrinsic value defined as values not assigned by humans but are instead inherent in the object or its relationship to other objects. Intrinsic values differ from other non-market values in that they are considered non-economic. **Intrinsic values** are often overlooked in environmental policy decision-making because they are typically more difficult to quantify than economic values.

Monitoring Measurable Parameters

There are a number of non-market valuation techniques available for measuring the value of goods and services in the absence of markets (see box below). Each of these has different strengths, weaknesses, assumptions, caveats and potential sources of error. We offer below some basic background information on some of the techniques used in determining non-market values. However, due to space limitations we cannot provide a detailed discussion of the complexities involved with implementing these techniques. Some suggested additional sources of information are given below and in the annotated bibliography at the end of this chapter. It is also strongly recommended that you consult with a non-market valuation expert before attempting to incorporate any of these methods into your restoration monitoring plan.

Economic Value Web Sites

Coastal and Ocean Resource Economics Program, NOAA, National Ocean Service. http:/marineeconomics.noaa.gov

Common Non-market Valuation Techniques
(Source: NOAA 1995)

- **Travel Cost Method** – Can be used to estimate recreational values associated with coastal restoration. This technique assumes that visitors to a particular site incur economic costs, in the form of outlays of time and travel expenses, to visit the site. In effect, these economic expenditures reflect the "price" (albeit implicit) of the goods and services provided by the site, and are an indirectly observable indication of the minimum amount that a visitor is willing to pay to use the site (with all its associated attributes). As coastal ecosystems become healthier one would expect both the number of people utilizing such areas for recreation and the average expenses incurred to get to those areas to increase.
- **Random Utility Models** – Also used for non-market recreation values. However, the focus of this method is on the choices or preferences of recreationists among alternative recreational sites. This type of model is particularly appropriate when substitutes are available to the individual so that the economist is measuring the value of the quality characteristics of one or more site alternatives (e.g., a fully restored coastal wetland and a degraded coastal wetland).
- **Hedonic Pricing Method** – Valuation technique intended to capture the willingness-to-pay measures associated with variations in property values that result from the presence or absence of specific environmental attributes (e.g., water pollution, scenic views, wildlife abundance). By comparing the market value of two properties that differ only with respect to a specific environmental attribute, economists may assess the implicit price of that amenity (or its cost when undesirable) by observing the behavior of buyers and sellers.
- **Contingent Valuation Method** – A direct way to measure non-market values by questioning individuals on their willingness-to-pay for a good or service (see above for survey research methods). The dollar values obtained for the good or service are said to be contingent upon the nature of the constructed (hypothetical or simulated) market and the good or service described in the survey scenario.

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IMPROVE GENERAL MARKET ACTIVITY

Goals and Objectives

The previous section discussed the restoration goal of enhancing the non-market value of goods and services for which no traditional market of buyers and sellers exists. The restoration of coastal habitats may also advance the economic goal of improving general market activity for goods and services that are routinely traded in traditional markets. Coastal restoration efforts that generate increased tourism, recreational and commercial activity will, in turn, improve general market activity. Objectives within this goal include increasing economic expenditures, total economic impacts, profits, jobs, and income levels within a given geographic area (e.g., county, region, state). The box below provides an explanation of economic expenditures and impacts using recreational fishing as an example.

Figure 25. Cigar's Marina in Louisiana is an example of a small business that offers fishermen a place to stay, eat, as well as go fishing. Photo by Lauri Lawson, NMFS, from the NOAA Photo Library. http://www.photolib.noaa.gov/fish/fish1208.htm

Economic Expenditures and Impacts Associated with Recreational Fishing
(Source: Salz et al. 2001)

During the course of a fishing trip, anglers purchase a variety of goods and services, spending money on bait, tackle, groceries, boat fees, lodging, restaurants, travel costs, and other trip-related expenditures. These purchases directly affect the sales, income, and employment of businesses that supply goods and services to saltwater anglers in a given geographic area. Businesses providing these goods and services must also purchase goods and services and hire employees, which in turn, generate more sales, income, and employment in an area. Three levels of economic impacts result from purchases by saltwater fishermen: 1) direct, 2) indirect, and 3) induced. Direct impacts are the sales, income, and employment generated from initial purchases (expenditures) by anglers (e.g., bait and tackle stores or sporting goods stores selling bait to anglers). Indirect impacts are sales, income, and employment of support industries that supply the directly affected industries (e.g., bait and tackle stores must purchase bait from dealers or fishermen, tackle from wholesalers, and electricity from power supply companies, and must pay labor). Induced impacts represent the sales, income, and employment resulting from expenditures by employees of the direct and indirect sectors (e.g., bait and tackle store employees purchase groceries and incur utility bills). Total impacts equal the sum of direct, indirect, and induced impacts.

Improving general market activity will also have the added public benefit of increasing state and local tax bases by generating additional sales tax and income tax revenue. In addition, revenues will also increase from special federal excise taxes on certain outdoor recreation related items (e.g., boat fuels, fishing, and hunting gear) that are dedicated towards resource conservation activities (i.e., Federal Aid in Sport Fish and Wildlife Restoration programs).

Monitoring Measurable Parameters

While detecting improvements in general market activity and attributing those changes to the improved health of restored coastal ecosystems may be possible for small individual projects, in many cases monitoring this goal will be more practical at the program level or for very large individual projects. There are three primary reasons for this: (1) many other social, economic, political, and environmental variables can influence trends in economic indicators and sorting these out on a small geographic scale is not often possible, (2) existing sources of economic data and model parameters for economic impact analyses are generally available at a larger spatial scale (i.e., county, metropolitan area, state) than most individual restoration projects cover, and 3) the cost of conducting an economic impact assessment for a small individual restoration project may be prohibitive and, in some cases, outweigh the benefits. Nonetheless, there may be some unique cases where it is possible to directly link expenditures and job creation to a particular project, even on a small geographic scale. For example, if restoration of some coastal habitat (e.g., coral reef, wetland) creates economic opportunities for eco-tourism providers that were not previously present at that location, the resulting jobs and profits can be directly attributed to the restoration project.

One way to monitor the goal of improving general market activity is to conduct an **economic impact analysis**. Economic impact analysis traces the flows of spending associated with tourism activity in a region to identify changes in sales, tax revenues, income, and jobs due to tourism activity. The principal methods utilized are spending surveys, analysis of secondary data from government economic statistics, economic base models, **input-output models** and **multipliers** (Frechtling 1994).

Input-output analysis (IOA) is the most common approach available for describing the structure and interactions of businesses in a regional economy. An IOA is capable of tracking the quantity and purchase location

of expenditures, support businesses, and employees of the directly and indirectly affected industries. Also, IOA assessments can be used to reveal how expenditures affect the overall economic activity in a particular region, such as sales, income, and employment. Regional modeling systems, such as **IMPLAN** (impact analysis for planning), are used by economists for IOA. IMPLAN (and other similar models) can help restoration practitioners determine the economic importance of particular coastal activities that are dependent upon healthy coastal ecosystems. Using IMPLAN, economic expenditure and impact data can be generated for each expenditure category (e.g., restaurant, lodging, automobile) at the county level.

Multipliers represent a quantitative expression of the extent to which some initial change in the market is expected to generate additional "ripple" effects throughout the economy. They express the degree of interdependency between sectors in a region's economy and therefore vary considerably across regions and sectors. Many different types of multipliers can be used when conducting an input-output analysis (IOA). Multipliers may be expressed as ratios of sales, income or employment, or as ratios of total income, or employment changes relative to direct sales. One commonly used multiplier for IOA is the ratio of the indirect and induced effects to the direct (i.e. the initial) change itself (see box titled "Economic Expenditures and Impacts Association with Recreataional Fishing" for an explanation of these effects).

Information for monitoring employment impacts and income levels can be obtained from the Federal Bureau of Labor Statistics (BLS, http://www.bls.gov) within the U.S. Department of Labor. This agency conducts surveys and compiles data on several employment indicators. Some of the BLS surveys that may be relevant for monitoring general market activity include:

- Nonfarm Payroll Statistics from the Current Employment Statistics (State & Area) - monthly data on employment, hours, and earnings by industry and geographic area.
- Quarterly Census of Employment and Wages - comprehensive employment and wage data by industry and geographic area for workers covered by State Unemployment Insurance laws.
- Occupational Employment Statistics - annual data on employment and wages for about 750 occupations and 400 nonfarm industries for the nation, plus occupational data by geographic area
- Local Area Unemployment Statistics - monthly and annual employment, unemployment, and labor force data for Census regions and divisions, States, counties, metropolitan areas, and many cities, by place of residence

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REDUCE PROPERTY DAMAGE / ENHANCE PROPERTY VALUE

Goals and Objectives

For certain projects, restoration of coastal areas can be beneficial to local landowners by reducing damage to their property caused by flooding, storms, water level fluctuations, erosion, and drought. Reduced property damage may also apply to public property and physical infrastructure (see box below on physical infrastructure). The role of coastal habitats (e.g., marshes, wetlands, SAV) in ameliorating hurricane storm surges depends on a variety of

factors including the physical characteristics of the storm, coastal geomorphic setting, and the track of a storm when it makes landfall. Human dimensions objectives under the goal of reducing property damage resulting from coastal flooding, storms, and/or erosion include reducing the:

- Number of houses lost
- Total cost of property damage
- Damage to transportation and commerce infrastructure (see the next section, *Enhance Transportation and Commerce*, for discussion of this objective)
- Amount of federal and state funds used for disaster relief
- Number of flood insurance claims filed
- Risk ranking for restored coastal areas on FEMA Flood Insurance Rate Maps
- Cost of insuring coastal property

In addition to these potential benefits, coastal restoration efforts may also reduce the necessity for coastal armorment projects (e.g., groins, sea walls, jetties). Armorment, or hard stabilization, solutions are often the traditional response for protecting upland property and structures from coastal erosion (Pilkey and Wright 1988). While armorment may, in some cases, be an effective way to reduce property damage, this approach has come under heavy criticism in recent years. Some of the negative impacts associated with sea walls, in particular, include:

- Aesthetic degradation of coastal viewscapes
- Reduction in access to the beach
- Production of rubble that can be dangerous to swimmers
- Increased erosion and degradation of beaches
- Degradation of habitat
- Increased taxpayer burden that only benefits a few property owners (Pilkey and Wright 1988; Dean 2001)

Virtually every state coastal management program has some regulatory component which either heavily discourages or completely prohibits construction of new hard stabilization structures. Coastal restoration may be a more socially and politically accepted substitute for armorment in reducing property damage in some areas.

About 90 percent of natural disasters in the United States are flood related and the majority of the damage caused by floods occurs in

Figure 26. Erosion at Oval Beach, Saugatuck, Michigan. Photo credit: Michigan DNR, Land and Water Management Division, Coastal Programs Unit, from the EPA Great Lakes web site.

Physical Infrastructure
(Source: Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority 1998)

Physical infrastructure refers to capital facilities and land assets - private, State, Federal, parish or municipal - that are necessary to (1) support development and (2) protect public health, safety, and well-being. It includes, but is not limited to, water supply and wastewater disposal, transportation (ports, roads, bridges, airports, rail, navigation, highways), solid waste disposal, drainage, flood protection, industrial parks, electricity, oil and gas structures, and educational facilities and parks.

coastal communities (Platt 1999). The National Flood Insurance Program (NFIP) was initiated in 1968 and since 1973 has been coordinated by the Federal Emergency Management Agency (FEMA). The goal of NFIP is to provide low-cost federal flood insurance to individuals living in communities with approved floodplain management regulations (see box on page 14.49 for more on NFIP). One criticism of the program is that in many years it operates in the red – i.e., program outlays exceed revenues resulting in net borrowing from the U.S. Treasury (Platt 1999). Therefore, restoration efforts that reduce the risks and costs associated with coastal flooding may also reduce the federal taxpayer subsidy created by NFIP claims.

The NFIP's Community Rating System (CRS) provides discounts on flood insurance premiums in those communities that establish floodplain management programs that go beyond NFIP minimum requirements. Communities receive flood insurance credits for coastal restoration projects that reduce the risk of erosion damage, protect natural and beneficial floodplain functions, create open space, and reduce flood damage to property. One example of mitigation activities eligible for NFIP credits is beach nourishment that focuses on facilitating natural dune replenishment through the planting of native dune vegetation. Placement of sand on beaches is not eligible for NFIP credits. Minor physical flood control projects such as stabilization of stream banks, modification of existing culverts, and creation of small stormwater retention basins may also be eligible. Major structural flood control (hard stabilization) structures, such as levees, dams, and seawalls are not eligible for NFIP premium discounts.

In addition to paying flood insurance claims, the federal government (and states to a lesser

Figure 27. Shoreline erosion - Red Lantern Restaurant, Lake Michigan, Indiana. Photo courtesy of R. Royce, National Park Service, Indiana Dunes National Lakeshore, obtained from EPA Great Lakes web site.

Figure 28. Shoreline erosion - house in shambles, Ogden Dunes Indiana. Photo courtesy of Carole Y. Swinehart, Michigan Sea Grant Extension, from the EPA Great Lakes web site.

extent) also allocates a tremendous amount of money for disaster relief. Hurricane Andrew, which hit southern Florida in 1992, resulted in $26.5 billion in damage alone (NOAA web site: http://www.noaa.gov/hurricaneandrew.html). While property damage caused by hurricanes, Nor'easters and other natural disasters cannot be avoided, it can, in some cases, be reduced through coastal restoration efforts. For more information on NFIP and federal disaster relief visit the FEMA web site at: http://www.fema.gov. State emergency management agencies (SEMAs) and local authorities may also be good sources of information.

National Flood Insurance Program
(Source FEMA 2002)

The NFIP is a Federal program that allows property owners in participating communities to purchase low-cost flood insurance in exchange for state and community floodplain management regulations (i.e., mitigation) that reduce future flood damages. This program is designed to provide an insurance alternative to disaster assistance to reduce the escalating costs of repairing damage to buildings and their contents caused by floods. The number of NFIP policies has increased from about 95,000 before the Flood Disaster Protection Act of 1973, to 2.2 million in 1989, to over 4.3 million in 2002. The amount of flood insurance coverage in force as of 2002 was over $606 billion.

The value of property adjacent (or in close proximity) to a coastal restoration project may also increase as a result of enhanced aesthetic and recreational values associated with the restored habitat. Improvements in viewscape quality, water quality and wildlife viewing opportunities after restoration, may all increase the market value of land and homes in the restored area (see section above titled "Enhance Non-market and Aesthetic Values"). Increased private property values also have the added public benefit of increasing tax revenues for the local community.

Monitoring Measurable Parameters

Data for monitoring property damage related measurable parameters such as flood zone map designations, flood insurance rates, and disaster relief expenditures are available from FEMA at the community level. FEMA has produced flood hazard maps for over 19,200 communities covering approximately 150,000 square miles of floodplain areas (FEMA 2002). Flood hazard maps are used for state and community floodplain management regulations, for calculating flood

insurance premiums, and for determining whether property owners are required by law to obtain flood insurance as a condition of obtaining mortgage loans or other Federal or federally related financial assistance. FEMA's flood hazard maps are also used by States and communities for emergency management and for land use and water resources (FEMA 2002). The Federal Insurance and Mitigation Administration (FIMA) and the FEMA Regional Offices conduct field investigations following major flood disasters to evaluate how well the NFIP floodplain management requirements performed. During these investigations, a team of experts inspects disaster-induced damages to residential and commercial buildings and other structures and infrastructure.

Detailed and accurate information on property damage caused by flooding may be more difficult to obtain since there is no one agency in the United States with specific responsibility for collecting and evaluating detailed flood loss information (NOAA, National Weather Service web site). This means that flood loss information can come from several sources using different methods for calculating and reporting damage. State and municipal losses are often self-insured. Some portion of the cost to repair a washed out road or bridge might be covered in a budget line item for routine maintenance, while another portion may be financed by a separate line item in the next year's budget. In some cases, a structure may be replaced by one of higher quality, costing more than the replacement value or repair costs of the original structure (NOAA, National Weather Service web site). For private property owners, some will either not have insurance or be under-insured. The costs for this sort of repair are almost impossible to establish. For those that are insured, claims may not fully reflect actual losses (NOAA, National Weather Service web site). While FEMA is a good place to start, restoration practitioners may also need to contact state and local agencies to monitor the goal of reducing property damage. For small projects, property loss data may be collected by surveying landowners in the vicinity of the restoration effort.

It may be possible to determine the effectiveness of a restoration effort in reducing property damage by directly comparing restored coastal areas with other nearby areas (non-restored) after a storm event. However, for a valid comparison which isolates the effect of the restoration effort, the two areas would have to be nearly identical in all other features that may influence level of property damage (e.g., hydrological, topographical, geological, building design). A study done in the aftermath of Hurricane Andrew clearly showed that the effect of storms on the human population and infrastructure in the coastal zone can be ameliorated by the maintenance of extensive coastal marshes and barrier islands (see box below, Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority 1998).

Practitioners should be able to locate data on both appraised and market property values

Hurricane Andrew Storm Surge
(Source: Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority 1998)

Hurricane Andrew gave direct evidence that the physiography of marshes where a storm makes landfall affects the degree to which the storm surge is dampened. The surge amplitude in the Terrebonne marsh system decreased from 9.3 ft above sea level in Cocodrie to 3.3 ft (Swenson 1994) in the Houma Navigation Canal approximately 23 miles due north. This equates to a reduction in surge amplitude of approximately 3.1 inches per linear mile of marsh and open water between Houma and Cocodrie. Similarly, the magnitude of the storm's surge was reduced from 4.9 ft at Oyster Bayou to 0.5 ft at Kent Bayou located 19 miles due north. This equates to a reduction in surge amplitude of approximately 2.8 inches per linear mile of fairly solid marsh between these sites.

in their area to determine whether a coastal restoration project has met the goal of enhancing property values. The appraised value is a certified appraiser's opinion of the worth of a home while the market value is what price the house will bring at a given point in time. Market data on property sales and characteristics are available through real estate services and municipal sources. A commonly used source of information on property values is the Multiple Listing Service (MLS), a service created and run by real estate professionals which gathers all of the property listings into a single place so that purchasers may review all available properties from one source.

However, tracking changes in nearby property values over the course of a restoration project alone will not indicate whether those changes are, in any way, the result of the restoration project. Property values (both appraised and market) fluctuate all the time due to numerous other factors (e.g., mortgage rates, inflation, employment trends). Isolating the effect of a restoration project on property values may be very difficult. One method used by resource economists that attempts to do just that is hedonic pricing. Hedonic pricing is a non-market valuation technique intended to capture the willingness-to-pay measures associated with variations in property values that result from the presence or absence of specific environmental attributes (e.g., water pollution, scenic views, wildlife abundance) (NOAA, National Weather Service 2000). By comparing the market value of two properties that differ only with respect to a specific environmental attribute, economists may assess the implicit price of that amenity (or its cost when undesirable) by observing the behavior of buyers and sellers. The validity of this method depends on the ability to find two houses that are so identical in all other attributes (e.g., schools, community services, air quality etc.) that the relatively small increase in value due to a restoration project will be detectable.

Coastal Property Damage and Property Value Web Sites

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ENHANCE TRANSPORTATION AND COMMERCE

Goals and Objectives

Throughout history coastal regions have been a focal point for trade, commerce, and navigation, all of which depend on reliable transportation. The nation's economy is highly dependent on coastal transportation (by water, road, and railway) for moving commodities and connecting our ports to the interior of the country and the rest of the world (see box below on coastal transportation in Louisiana). Both catastrophic (e.g., hurricanes) and non-catastrophic (e.g., beach erosion) processes, such as flooding, drought, erosion, and sedimentation can negatively impact coastal transportation. As coastal areas become more crowded with tourists and residents, the need for efficient and reliable transportation becomes even greater. This is particularly true during coastal hazards when millions of people need to be evacuated from a relatively small area in a short period of time. With the projected rise in sea level, protection of low-lying coastal areas, and particularly coastal evacuation routes, from flooding will likely become more of an issue in the next century. Some coastal restoration objectives associated with the goal of enhancing transportation and commerce include reducing the:

- Sedimentation of navigation channels and inlets
- Flooding of roads, bridges, railroads, and evacuation routes
- Breaching of barrier islands, and
- Damage to coastal infrastructure and ports

While such processes are naturally occurring, their effects can be greatly worsened by anthropogenic degradation of coastal habitats. As discussed earlier (see "Reduce Property Damage" section), many coastal habitats function as a natural buffer, lessening the damage to property, roads, infrastructure, and navigation channels resulting from these coastal processes. Therefore, another human dimensions goal of coastal restoration is to restore the damage-preventing functions performed by coastal habitats in order to enhance transportation efficiency, reliability, and safety. Seawalls and other hard stabilization structures are often constructed for this purpose. However, as discussed in the previous section, in some areas coastal restoration may be a viable and socially

Coastal Transportation in Louisiana
(Source: Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority 1998)

Louisiana provides a prime illustration of the importance of coastal transportation to the economy of coastal regions and the nation as a whole. Louisiana ranks first in the nation in total shipping tonnage, handling over 450 million tons of cargo each year through the public and private installations located within the State's jurisdiction of six deep-draft ports: New Orleans, Greater Baton Rouge, Lake Charles, South Louisiana, Plaquemines Parish, and St. Bernard. These ports are the mainstays of Louisiana's maritime shipping industry, and have given the region both national and international prominence. In addition, the privately owned Louisiana Offshore Oil Port offloads approximately 10-13% of the country's imported crude petroleum that eventually is moved via pipelines to refineries and consumers throughout the nation. Significant contributions to the State's economy are also made by the fifteen smaller ports that are situated within the coastal zone, primarily serving the oil and gas and fishing industries. The Gulf Intracoastal Waterway is a critical shallow-draft transportation link that carries an annual average of 70 million tons of freight (primarily liquid bulk items such as petroleum and petroleum products) between the Mississippi and Texas state lines. An alternate Gulf Intracoastal Waterway route, linking Morgan City and Port Allen, averages 25 million tons of cargo shipped per year. In addition to the 3,000 miles of commercially navigable waterways, coastal Louisiana has railroad transportation, Interstate, U.S. and state highways, commercial and general aviation airports, and an extensive network of oil and gas pipelines.

preferred solution for protecting transportation infrastructure (e.g., roads, bridges, railroads, evacuation routes).

Restoration projects may also promote an increase in coastal transportation facilities (e.g., marinas, boat ramps, boat slips, and commercial docks) and accessibility (e.g., roads) which can also be viewed as transportation related benefits of restoration. However, since such benefits may conflict with other ecological and human dimensions goals/objectives, they may not be desirable goals for all projects. In other cases, the goal of enhancing transportation will be compatible and closely linked to several human dimensions goals discussed in this chapter. Enhanced transportation will likely increase the level of coastal recreation and tourism, improve general market activity, reduce property damage, enhance property value, and improve commercial fishing.

Monitoring Measurable Parameters

Measurable parameters for monitoring the effectiveness of a restoration project in protecting transportation and commerce related infrastructure (e.g., roads, bridges, railroads, ports, evacuation routes) from flooding and other damage are discussed above in the section titled *Reduce Property Damage / Enhance Property Value*. These include changes in FEMA flood risk assessments for particular areas, as well as the costs associated with repairing damaged transportation infrastructure. By comparing historical data with post-restoration data it may be possible to determine if a particular restoration effort has reduced the flooding potential and/or damage to a given stretch of road. Practitioners should use caution, however, in drawing such cause-and-effect conclusions. Other factors, not related to the restoration project, such as construction of hard stabilization structures, changes in hydrology and geomorphology, sea level changes, and tidal fluctuations can also influence these measurable parameters. By directly comparing a restored stretch of coast with a nearby unrestored stretch it may be possible to isolate the effectiveness of restoration in reducing road damage and flooding (i.e., assuming all other characteristics of the two areas are nearly identical). State departments of transportation can provide you with detailed coastal evacuation maps if you are particularly interested in monitoring the effectiveness of a restoration project in reducing road damage and flooding of evacuation routes.

Figure 29. Destruction of the seawall at Narragansett Pier in southern Rhode Island due to the New England Hurricane of 1938. Archival Photography by Steve Nicklas, NOS, NGS, from the NOAA Photo Library.

Coastal restoration efforts that abate the processes of erosion, sedimentation, and flooding, may also reduce the costs associated with hard stabilization and channel dredging designed to protect transportation routes. Monitoring these costs over time may provide some indication of the effectiveness of coastal restoration in enhancing transportation. In most cases, such monitoring will be more feasible at the program level as the influence on hard stabilization and channel-dredging costs of multiple restoration projects over a large geographic area will be more detectable than any one individual project. Information on hard stabilization and channel dredging costs can be obtained from the Army Corps of Engineers, the agency that coordinates most of these projects, or from state and local coastal management agencies.

Monitoring measurable parameters related to transportation facilities and accessibility at the project level is fairly straightforward. For individual projects, an inventory can be kept to track changes over time in the number of marinas, boat slips, boat ramps, and access points that are directly the result of a restoration effort. However, it may not always be possible to link increased demand for transportation facilities and coastal access to restoration within a small geographic area. Rather, changes in these parameters are more likely to result from the cumulative effect of many restoration projects rather than any one individual project. Therefore, these measurable parameters may provide a better measure of transportation related goals and objectives if they are monitored at the program level (e.g., estuary, watershed, state). Most state coastal management agencies keep a detailed inventory of coastal access points, marinas, and launch sites that can be used for monitoring purposes.

Coastal Transportation References

- Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority. 1998. Coast 2050: Toward a Sustainable Coastal Louisiana. 161 pp. Louisiana Department of Natural Resources. Baton Rouge, LA. http://www.lacoast.gov/Programs/2050/MainReport/report1.pdf

IMPROVE COMMERCIAL FISHERIES AND SHELLFISHERIES

Goals and Objectives

Coastal habitats serve as breeding, nursery and feeding grounds for many species of commercially valuable fish and shellfish (see specific habitat chapters for more detail on this ecological function). The majority of commercially harvested fish and shellfish are dependent on estuaries and their wetlands (see box on Habitat Loss in the Gulf of Mexico below). When these habitats become degraded, their ability to produce healthy, abundant, and sustainable fish populations is greatly diminished. Therefore, an important human dimensions goal of coastal restoration is to improve commercial fisheries and promote sustainable fishing communities by restoring fish and shellfish habitats. This overall goal includes both socio-cultural and economic objectives. For a discussion of the socio-cultural and historical heritage values associated with commercial fishing communities see previous section titled "Protect Traditional, Cultural and Historic Values". In addition to these values, commercial fisheries also have tremendous economic value. Nationally, commercial fisheries landings (all species) weighed 9.4 billion pounds and were valued at $3.2 billion in 2002 (NOAA, NMFS, Commercial Fisheries web site). Economic objectives of coastal restoration may include increasing the total commercial fishing and shellfishing harvest value, increasing total profits, and increasing the number of jobs in the fishing industry.

If improving commercial fisheries is a primary goal of your project, it is important

Figure 30. Sorting the catch. Photo by NOAA Office of Marine and Aircraft Operations, from the NOAA Photo Library. http://www.photolib.noaa.gov/fish/fish0058.htm

to consider which particular types of fisheries or fishing sectors you want to improve, and focus your restoration efforts accordingly. One major distinction when considering commercial fisheries is between large-scale and small-scale operations (although there are gradients in between these extremes). **Large-scale commercial fishing** fleets, owned by corporations with large capital investments, are highly mobile in their global pursuit of fish populations. By comparison, **small-scale fishing operations** have relatively small capital investment and levels of production, and are more limited in terms of mobility and resource options. Terms that are commonly used to describe small-scale fishermen include artisanal, native, coastal, inshore, tribal, peasant, and traditional. If the objective is to enhance cultural values associated with fishing communities, not just economic values, emphasis should be placed on restoring ecosystems that will benefit small-scale fishing operations.

Fishing operations also differ in terms of species targeted and gear used. While some target species populations are being managed sustainably, many others are depleted and continue to be overfished. Certain commercial fishing gear types are particularly harmful to marine ecosystems in terms of habitat destruction (e.g., bottom trawling), incidental mortality (e.g., dolphins in tuna purse seine nets) and bycatch (e.g., discarded dead juvenile fish caught in shrimp trawl nets). Therefore, when designing coastal habitat restoration projects aimed at benefiting commercial fisheries, practitioners need to decide which commercial fishery (i.e., scale, gear type, species) they want to improve. In doing so they should consider what the ecological and human dimensions objectives

Habitat Loss in the Gulf of Mexico
(Source: Gulf Restoration Network web site - http://www.gulfrestorationnetwork.org/)

Over 50 percent of the Gulf region's wetlands have been lost since 1790. Furthermore, the Gulf ranked as one of the worst regions in the country in a recent Environmental Protection Agency report in terms of coastal water pollution and toxicity. Coastal wetlands are extremely important to the majority of the Gulf's fish species due to their dependence on both estuarine and marine waters at some point in their life cycle. It is currently estimated that 95 percent of the commercially and recreationally important species in the Gulf of Mexico depend on both the waters of the open Gulf and the inshore and nearshore waters of the Gulf's numerous bays and estuaries. Some representative species include shrimp, red drum, and king mackerel.

Figure 31. Harvesting the herring after closing the purse on the Maine coast (1969). Photo from the NOAA Photo Library. http://www.photolib.noaa.gov/fish/fish0771.htm

of the project are and what the consequences of improving that fishery will be.

Monitoring Measurable Parameters

Restoration of nearly every habitat included in this volume will likely have some positive impact on commercially sought after species of fish and shellfish. However, depending on the mobility of these species, actually monitoring improvements in commercial fishing due to restoration efforts may be extremely difficult, especially at the individual project level. For sedentary species, such as oysters and clams, practitioners can monitor the commercial harvest within a designated restored area over time to determine if restoration helped to improve that fishery. However, many other commercially important species (particularly finfish) may only spend part of their life-cycle (e.g., juvenile stage) within a restored area. Since the mature stocks of fish are usually geographically far removed from the nursery grounds, the fishery benefits in terms of increased productivity and profits will also be far removed (Wiegert and Pomeroy 1981). This is particularly true for highly migratory species such as striped bass, bluefish, and salmon that may travel thousands of miles throughout their lives. Establishing a direct causal link between a particular restoration effort and improvement of a commercial fishery is made more difficult by all the extraneous environmental, regulatory, technological, economic, and social factors that can influence fishery yields. With the exception of relatively sedentary species, monitoring improvements in commercial fisheries due to restoration is more likely to be successful at the program level. For example, the recovery of striped bass populations along the Atlantic coast in the early 1990's is attributed to a combination of restrictive fishing regulations and restored breeding and rearing inland habitats (e.g., Hudson River and Chesapeake Bay watersheds). The use of ecological indicators such as striped bass larval and juvenile fish abundance (i.e., young-of-year indices) to predict adult year-class strength reaffirms the link between habitat restoration and fisheries productivity.

Commercial fisheries data, including catch, weight, and harvest value are routinely collected by state and federal fisheries agencies (See *Commercial Fishing and Shellfishing Data Sources* below). These **fishery dependent data** (i.e., data collected directly from the fishery participants) are typically summarized at the state level. In some cases, fishery landings data such as the number, weight, and value of fish by species, gear type, and ocean area may be available for individual fishing ports. However, the port at which fisheries catches are landed may be geographically far removed from where the fish were actually caught. For purposes

of restoration monitoring it is important to make this distinction in order to assess the effectiveness of a restoration effort in increasing fisheries yields.

Fisheries dependent data may not be readily available or summarized in a format useful for small-scale or individual project monitoring. Information collected from fishermen on geographic area of the catch is often not detailed enough to establish a relationship between a given restoration effort and increased fishery productivity. For sedentary species, practitioners can conduct their own surveys of commercial fishermen to track changes in harvest value following a restoration effort. In most commercial fisheries, participants are required to have a license or permit to participate. Practitioners may be able to gain access to these databases from state and federal agencies in order to establish a sampling frame for the collection of commercial fisheries data (Refer to section on page 14.14 titled "Coastal Recreation, Tourism, and Access" for general information on survey methodology).

In addition to measurable parameters based on fisheries dependent data, certain health related measurable parameters may also be directly linked to improved commercial fishing and shellfishing. As the number and severity of fish and shellfish advisories decrease and the level of seafood safety increases, consumers will buy more seafood, thus benefiting the commercial fishing industry. Likewise, water quality improvements resulting from restoration efforts will reduce the number of hypoxia events, thus reducing the magnitude of fish kills and perhaps opening up new areas for commercial fishing and shellfishing.

Commercial Fishing and Shellfishing Data Sources and Web Sites

- Atlantic Coastal Cooperative Statistics Program (ACCSP) web site: http://www.accsp.org/
- Fisheries of the United States, 1977 through 2002 (annual publication). U.S. Dept. Of Commerce, NOAA Fisheries, Washington, D.C. http://www.st.nmfs.gov/st1/fus/current/
- Gulf States Marine Fisheries Commission (GSMFC), Gulf States Fisheries Information Network (Gulf FIN) web site: http://www.gsmfc.org/data.html
- NOAA, National Marine Fisheries Service (NMFS), Commercial Fisheries web site: http://www.st.nmfs.gov/st1/commercial/index.html
- NOAA, National Marine Fisheries Service (NMFS), Social Sciences Branch web site: http://www.nefsc.noaa.gov/read/socialsci/

Figure 32. The Lobstermen's Co-op in Boothbay Harbor, Maine. Photo from William B. Folsom, NMFS, obtained from the NOAA Photo Library. http://www.photolib.noaa.gov/fish/fish0961.htm

- Pacific States Marine Fisheries Commission (PSMFC), Pacific Coast Fisheries Information Network (PacFIN) web site: http://www.psmfc.org/pacfin/index.html
- Pacific States Marine Fisheries Commission (PSMFC), Fisheries Economics Data Program (EFIN) in the Northwest and Alaska web site: http://www.psmfc.org/efin/index.html
- State marine resource agencies are also a good source of commercial fisheries information (too many to list here).

Commercial Fishing and Shellfishing References

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Figure 33. Sunset along the Patuxent River, Maryland. Photo by Mary Hollinger, NODC biologist, NOAA, obtained from the NOAA Photo Library. http://www.photolib.noaa.gov/coastline/line2329.htm

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NOAA Coastal Services Center, Human Dimensions of Coastal Management web site: http://www.csc.noaa.gov/techniques/humandimensions/index.html

NOAA International Year of the Ocean web site: http://www.yoto98.noaa.gov

NOAA, NMFS (National Marine Fisheries Service), Commercial Fisheries web site: http://www.st.nmfs.gov/st1/commercial/index.html

NOAA, National Weather Service. 2000. Hydraulic Information Center web site "Flood Losses": http://www.nws.noaa.gov/oh/hic/flood_stats/Flood_loss_time_series.htm

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APPENDIX I: MATRIX OF HUMAN DIMENSIONS GOALS AND MEASURABLE PARAMETERS TO MONITOR

As discussed above under *Project Scale Issues* some of the measurable parameters for assessing human dimensions goals may be difficult to monitor for individual or small-scale projects. The closed circles below (●) indicate, for each particular goal, which parameters restoration practitioners *should* be able to monitor regardless of project size or scope. The open circles (○) indicate parameters that may be possible to monitor for *some* individual or small-scale projects but in other instances monitoring such parameters may only be feasible at the restoration program level (i.e., estuary, watershed etc.). These circles are intended to provide only broad general guidance and exceptions may exist for any given restoration project. Practitioners are encouraged to consult with human dimensions experts (see Appendix IV) and carefully evaluate the feasibility of monitoring any of these parameters for their particular project.

Parameters for Monitoring Human Dimensions Goals of Coastal Restoration

Parameters for Monitoring	Coastal Recreation, Tourism, and Access Related Goals					General Social & Non-market Values Related Goals						Market-based Goals				
	Increase Number of Recreational Opportunities (pg 16)	Increase the Level of Recreation Activity (pg 16)	Increase the Quality of Recreational Opportunities (pg 17)	Improve Tourism/Ecotourism (pg 17)	Enhance Access to Coastal Resources (pg 17)	Enhance Community Investment (pg 23)	Enhance Educational Opportunities (pg 29)	Protect or Improve Human Health (pg 30)	Protect Traditional/Cultural/Historic Values (pg 36)	Enhance Non-Market Values (pg 41)	Improve Aesthetic Values (pg 41)	Improve General Market Activity (pg 43)	Reduce Property Damage (pg 46)	Enhance Property Value (pg 46)	Enhance Transportation and Commerce (pg 51)	Improve Commercial Fisheries/ Shellfisheries (pg 54)
Recreation / Tourism Related																
Facilities and Accessibility																
Number of Public Access Points	●			●	●										●	
Number of Private Access Points	●			●	●										●	
Number of Marinas	●			●	●										●	
Number of Boat Slips	●			●	●										●	
Number of Boat Ramps	●			●	●										●	
Trail Miles	●			●	●											
Number of Commercial Providers	●			●	●											
Infrastructure Development	❍			❍	❍										❍	
Functional/Service Capacity	❍			❍	❍											
Level of Facility Maintenance			●													
Perceptions of Conflict and Crowding																
Consumptive users (hunters, anglers, trappers, clamers)			❍													
Non-consumptive users (birders, beach users, divers/snorkelers, boaters, hikers)			❍													
User Satisfaction Rating																
Consumptive users (hunters, anglers, trappers, clamers)			❍	❍												

Parameters for Monitoring Human Dimensions Goals of Coastal Restoration (cont.)

Parameters for Monitoring	Coastal Recreation, Tourism, and Access Related Goals					General Social & Non-market Values Related Goals						Market-based Goals				
	Increase Number of Recreational Opportunities (pg 16)	Increase the Level of Recreation Activity (pg 16)	Increase the Quality of Recreational Opportunities (pg 17)	Improve Tourism/Ecotourism (pg 17)	Enhance Access to Coastal Resources (pg 17)	Enhance Community Investment (pg 23)	Enhance Educational Opportunities (pg 29)	Protect or Improve Human Health (pg 30)	Protect Traditional/Cultural/Historic Values (pg 36)	Enhance Non-Market Values (pg 41)	Improve Aesthetic Values (pg 41)	Improve General Market Activity (pg 43)	Reduce Property Damage (pg 46)	Enhance Property Value (pg 46)	Enhance Transportation and Commerce (pg 51)	Improve Commercial Fisheries/ Shellfisheries (pg 54)
Non-consumptive users (birders, beach users, divers/snorkelers, boaters, hikers)			❍	❍												
Recreational Fishing Catch Indicators																
Catch rates			❍	❍												
Average size per fish			❍	❍												
Availability of preferred target species			❍	❍												
Number of trophy fish caught			❍	❍												
Annual Recreation Visitor Days																
Consumptive days (hunting, fishing, shellfishing, trapping)		❍		❍	❍											
Non-consumptive days (birding, beach use, diving/snorkeling, boating, hiking)		❍		❍	❍											
Watchable Fish and Wildlife Counts	❍			❍							●					
Economic Indicators																
Economic Expenditures		❍		❍								❍				
Economic Impacts		❍		❍								❍				
Employment Impacts		❍		❍								❍				

Parameters for Monitor Human Dimensions Goals of Coastal Restoration (cont.)

Parameters for Monitoring	Coastal Recreation, Tourism, and Access Related Goals					General Social & Non-market Values Related Goals						Market-based Goals				
	Increase Number of Recreational Opportunities (pg 16)	Increase the Level of Recreation Activity (pg 16)	Increase the Quality of Recreational Opportunities (pg 17)	Improve Tourism/Ecotourism (pg 17)	Enhance Access to Coastal Resources (pg 17)	Enhance Community Investment (pg 23)	Enhance Educational Opportunities (pg 29)	Protect or Improve Human Health (pg 30)	Protect Traditional/Cultural/Historic Values (pg 36)	Enhance Non-Market Values (pg 41)	Improve Aesthetic Values (pg 41)	Improve General Market Activity (pg 43)	Reduce Property Damage (pg 46)	Enhance Property Value (pg 46)	Enhance Transportation and Commerce (pg 51)	Improve Commercial Fisheries/ Shellfisheries (pg 54)
Income Level				❍								❍				
Community Related																
Presence in Community Master Plan						●			●							
Component of Town Meetings						●			●							
Attendance at Town Meetings						●										
Community Communications						●										
Volunteerism (number of persons)						●										
NGO Activity						●										
Town Use of Restored Coastal Area		●				●										
Town Portion of Cost Sharing						●										
Corporate Sponsorship						●										
Zoning Changes						●										
Tax Incentives						●										
Community Member Attitudes						●										
Property Damage Related																
Flood Zone Map													●		●	
Number of Losses													❍			
Disaster Relief Costs													❍			
Direct Cost of Damage													❍		❍	

Parameters for Monitor Human Dimensions Goals of Coastal Restoration (cont.)

Parameters for Monitoring	Coastal Recreation, Tourism, and Access Related Goals					General Social & Non-market Values Related Goals						Market-based Goals				
	Increase Number of Recreational Opportunities (pg 16)	Increase the Level of Recreation Activity (pg 16)	Increase the Quality of Recreational Opportunities (pg 17)	Improve Tourism/Ecotourism (pg 17)	Enhance Access to Coastal Resources (pg 17)	Enhance Community Investment (pg 23)	Enhance Educational Opportunities (pg 29)	Protect or Improve Human Health (pg 30)	Protect Traditional/Cultural/Historic Values (pg 36)	Enhance Non-Market Values (pg 41)	Improve Aesthetic Values (pg 41)	Improve General Market Activity (pg 43)	Reduce Property Damage (pg 46)	Enhance Property Value (pg 46)	Enhance Transportation and Commerce (pg 51)	Improve Commercial Fisheries/ Shellfisheries (pg 54)
Insurance Losses													❍			
Uninsured Losses													❍			
Reduced Insurance Costs													❍			
Expenditures on Non-Restoration Projects (e.g., costs associated with coastal armament and channel dredging)													❍		❍	
Education Related																
Number of Interpretive Centers				●			●									
Number of Interpretive Programs				●			●									
Number of Research Projects							●									
Number of Students Trained							●									
Cost of Research Projects							●									
School Field Trips							●									
Classroom Activities							●									
Association With Museums	●						●									
Informal Education: Media coverage, websites, brochures, kiosks, workshops and public forums				●			●									

Parameters for Monitor Human Dimensions Goals of Coastal Restoration (cont.)

Parameters for Monitoring	Coastal Recreation, Tourism, and Access Related Goals					General Social & Non-market Values Related Goals						Market-based Goals				
	Increase Number of Recreational Opportunities (pg 16)	Increase the Level of Recreation Activity (pg 16)	Increase the Quality of Recreational Opportunities (pg 17)	Improve Tourism/Ecotourism (pg 17)	Enhance Access to Coastal Resources (pg 17)	Enhance Community Investment (pg 23)	Enhance Educational Opportunities (pg 29)	Protect or Improve Human Health (pg 30)	Protect Traditional/Cultural/Historic Values (pg 36)	Enhance Non-Market Values (pg 41)	Improve Aesthetic Values (pg 41)	Improve General Market Activity (pg 43)	Reduce Property Damage (pg 46)	Enhance Property Value (pg 46)	Enhance Transportation and Commerce (pg 51)	Improve Commercial Fisheries/ Shellfisheries (pg 54)
Human Health Related																
Number of Health Advisories																
Fish Advisories								❍								❍
Shellfish Advisories	●		●	●				●								●
Drinking Water Advisories								❍								
Number, Area and Duration of Beach Closures	❍		❍	❍				❍								
Incidence of Disease								❍								
Level of Compliance With Water Quality Standards								❍								
Level of Reduction in BioToxins								❍								
Number of Hazardous Sources								❍								
Number and Area of Algal Blooms								❍								
Duration of Algal Blooms								❍								
Number of Hypoxia Events								❍								❍
Number of Water-Borne Illnesses								❍								
Level of Food Safety								❍								❍
Commercial Fishing Related																
Number of Dock Facilities (commercial)					●										●	●
Total Profits												❍				❍

Parameters for Monitor Human Dimensions Goals of Coastal Restoration (cont.)

Parameters for Monitoring	Coastal Recreation, Tourism, and Access Related Goals					General Social & Non-market Values Related Goals						Market-based Goals				
	Increase Number of Recreational Opportunities (pg 16)	Increase the Level of Recreation Activity (pg 16)	Increase the Quality of Recreational Opportunities (pg 17)	Improve Tourism/Ecotourism (pg 17)	Enhance Access to Coastal Resources (pg 17)	Enhance Community Investment (pg 23)	Enhance Educational Opportunities (pg 29)	Protect or Improve Human Health (pg 30)	Protect Traditional/Cultural/Historic Values (pg 36)	Enhance Non-Market Values (pg 41)	Improve Aesthetic Values (pg 41)	Improve General Market Activity (pg 43)	Reduce Property Damage (pg 46)	Enhance Property Value (pg 46)	Enhance Transportation and Commerce (pg 51)	Improve Commercial Fisheries/ Shellfisheries (pg 54)
Number of Jobs												❍				❍
Total Value of Harvest												❍				❍
Sustainability of Fishery																❍
Cultural/Historical Heritage Preservation									❍							❍
Other Social Values																
Property Values																
Appraised Value													●	●		
Market Value													●	●		
Viewscape quality			●	●						●	●			●		
Acres of Land Preserved/Open Space											●					
Preserved Natural/Historic/Cultural Values									❍							
Level of Existence Value										●						
Level of Bequest Value										●						
Level of Option Value										●						
Historic Designation				●					●							
Tribal Designation									●							

APPENDIX II: HUMAN DIMENSIONS ANNOTATED BIBLIOGRAPHY

This annotated bibliography contains summaries of selected data sources and human dimensions research that coastal restoration practitioners may find useful in monitoring the human dimensions goals and objectives of a restoration project. Entries are presented from both peer reviewed and gray literature. Entries were selected through extensive literature and Internet searches as well as input from reviewers and workshop participants. This bibliography is not, however, intended to be a complete listing of all the available literature on the human dimensions of coastal restoration. Restoration practitioners and others are encouraged to do their own project specific literature search and to contact human dimensions experts for additional sources of information.

Entries are organized into the following sections:

1. Coastal Recreation Data Sources (National and Regional Surveys, State Level Surveys)
2. Economic Impact and Non-market Valuation Studies
3. Research on Stakeholders' Values, Attitudes and Satisfaction Ratings
4. Commercial Fishing: Human Dimensions Research
5. Education and Outreach Research
6. Socio-Cultural and Anthropological Research
7. Coastal Restoration and Property Damage Reduction
8. Effects of Coastal Restoration on Property Values
9. Human Dimensions Benefits of Improved Water Quality
10. Miscellaneous Human Dimensions of Coastal Restoration Monitoring References

Within each section entries are arranged alphabetically by author (or by data source name in the case of data sources). Wherever possible, web addresses or other contact information has been included in the reference to assist readers in more easily obtaining the original publication or data source. All summaries in this annotated bibliography were taken directly from their original source (i.e., either author abstract, source's web page, or publisher's introduction). In some cases, these original sources were condensed or modified slightly as necessary.

1. Coastal Recreation Data Sources

National and Regional Surveys

- **Marine Recreational Fisheries Statistics Survey (MRFSS)**

This saltwater angler survey has been conducted by NMFS annually since 1979. The MRFSS consists of two independent surveys--a telephone household survey and an intercept survey. Data obtained from the telephone survey are used to generate state-level estimates of fishing effort (measured as number of trips) according to mode (shore, partyboat/charterboat, or privateboat) and wave (2-month sampling period). Data obtained from the intercept survey are used to estimate catch per trip and average weight by species at the state/mode/wave level of detail. Data from the telephone household survey and the intercept survey are combined to provide an estimate of the total catch (number harvested, number released, and total weight) by marine recreational anglers also at the state/mode/wave level. The MRFSS also provides an estimate

of the number of marine recreational anglers in the United States by state of residence. The web site below provides instructions for conducting your own data queries online and for downloading raw (unsummarized) telephone and intercept datasets. http://www.st.nmfs.gov/st1/recreational/data.html

- **National Survey of Fishing, Hunting, and Wildlife-Associated Recreation**

The National Survey of Fishing, Hunting, and Wildlife-Associated Recreation has been conducted by the U.S. Fish and Wildlife Service about every five years since 1955. It provides information on the number of participants in fishing, hunting, and wildlife watching (observing, photographing, and feeding wildlife), and the amount of time and money spent on these activities. This survey is one of the nation's most important wildlife recreation databases. It is the only source of comprehensive information on participation and expenditures that is comparable on a state-by-state basis. It is used for estimating the economic impact of wildlife-related recreation for each state; for estimating the value of wildlife resources lost due to pollution or disease such as whirling disease in fish; for use in critical habitat analysis of threatened species; and for preparing environmental impact statements, budgets, and legislative proposals. http://fa.r9.fws.gov/surveys/surveys.html

- **National Survey on Recreation and the Environment**

The National Survey on Recreation (NSRE) was started in 1960 by the congressionally created Outdoor Recreation Resources Review Commission (ORRRC). Since that time, six national surveys have been conducted, in 1965, 1970, 1972, 1977, 1982-83, 1994-95, in addition to the latest 2000 NSRE. One component of the NSRE is the Marine Recreation Participation Module (includes Great Lakes). The main measurements for marine recreation are number of participants and number of days of use in the state in which the activity took place. The relevant population includes all people 16 years of age or older in the civilian non-institutionalized population living in U.S. households. The NSRE 2000 is a rich database that includes full demographic information, information on environmental attitudes, life-styles, and other data to support trip modeling. http://marineeconomics.noaa.gov/NSRE/NSRE_2.pdf
http://marineeconomics.noaa.gov/NSRE/NSRE_V1-6_May.pdf

- **NOAA Coastal and Ocean Resource Economics Web Page**

The Coastal and Ocean Resource Economics (CORE) Program conducts marine-related socioeconomic research for a wide variety of applications and geographic areas. CORE projects include state-of-the-art socioeconomic monitoring in the Florida Keys National Marine Sanctuary, the first-ever nationwide estimate of participation rates in marine-related recreation activities, an extensive beach valuation effort in Southern California, and many other research activities. http://www.marineeconomics.noaa.gov/welcome.html

- **Saltwater Angler Expenditures in the U.S.**

This three-part National Marine Fisheries Service study on Saltwater Angler Expenditures in the U.S. provides state-level estimates for angler trip and durable good expenditures by fishing mode (party/charter, private/rental boat and shore) and by state resident/non-resident status. With the exception of TX, AK, and HI, estimates are provided for all coastal states. Trip expenditure categories include transportation, food, lodging, fuel, charter and launch fees, equipment rental, bait, and ice. Expenditure categories for durable and semi-durable goods

used primarily for saltwater fishing include equipment and tackle, boat purchases, boat expenses, electronics, camping equipment, binoculars, clothing, and more.

Northeast Region: http://www.rbff.org/research/nemarine.pdf
Southeast Region: http://www.rbff.org/research/SEMarine.pdf
Pacific Region: http://www.rbff.org/research/SEMarine.pdf

Selected Examples of State Level Surveys

- **2000 Southeast Alaska Commercial Recreation Survey**

Conducted by the Alaska Division of Community and Business Development, this survey was designed to collect information about SE Alaska that allows businesses, communities, tourism organizations, and land management agencies to:

- Identify the type, quantity, and quality of commercial uses
- Identify sites that have a high degree of potential as future tourism destinations
- Determine the quality of existing services and access points to public lands/waters
- Determine new services and access points needed on public lands/waters
- Identify areas of existing or potential conflict by user groups
- Estimate the impact of the tourism industry on the economy and employment of SE Alaska
- Determine the environmental and social settings that have positive and negative impacts on business
- Identify obstacles to the success of tourism businesses in the region, and
- Identify ways in which federal, state and local governments can better serve the needs of business and augment the recreation experience of their clients.

- **A Baseline Socioeconomic Study of Massachusetts' Marine Recreational Fisheries**

This is a collaborative study conducted by the University of Massachusetts, National Marine Fisheries Service, and Massachusetts Division of Marine Fisheries. This study investigated various socioeconomic attributes of Massachusetts' marine recreational anglers. Separate analyses were conducted for each of three saltwater angler modes of fishing: partyboat, private boat, and shore. Areas of investigation included:

- Evaluation of Massachusetts saltwater anglers' attitudes towards specific fishery management actions and management agencies
- Determination and evaluation of anglers' economic expenditures and economic impacts according to economic sector and fishing mode
- Evaluation of angler species preferences and trends in demand for species-specific fishing activity
- Evaluation of angler switching among fishing modes
- Evaluation of the demand for fishing opportunities and access to fishing locations by fishing mode
- Identification and evaluation of anglers motivations, expectations, and outcomes related to saltwater fishing. http://www.nefsc.noaa.gov/nefsc/publications/tm/tm165/tm165.pdf

- **Southern California Beach Valuation Project**

This multi-agency effort was initiated by two offices in NOAA, The National Ocean Service's Special Projects Office and the

Damage Assessment Center, for the purpose of estimating the market and non-market values of recreation uses of Southern California Beaches, beach visitation, the effect of beach attributes, substitution issues, and profiles of beach users on values. The project will result in a system to use this information to estimate values for any beach in the region. http://marineeconomics.noaa.gov/SCBeach/welcome.html

- **Statewide Comprehensive Outdoor Recreation Plan (SCORP)**

To qualify for Land and Water Conservation Act funds states must prepare a comprehensive plan for outdoor recreation. State agencies rely on survey research to collect information that is used in their plan. SCORPs often include information on outdoor recreation supply and demand, needs analysis, trends, community park and recreation planning, statewide recreation goals and priorities, and other issues. Contact the appropriate natural resource agency for more information on the SCORP in your state. A sample SCORP for the state of Oregon can be found at: http://www.prd.state.or.us/scorp_review.php

2. Economic Impact and Non-market Valuation Studies

Bell, F. W. and V. R. Leeworthy. 1986. An Economic Analysis of the Importance of Saltwater Beaches in Florida. Florida Sea Grant Report 82, pp. 1-166, Florida Sea Grant Program, University of Florida, Gainesville, FL.

To evaluate the economic impact and recreational value of saltwater beaches in Florida, two surveys were conducted over the 1983-84 period. The first surveyed out-of-state tourists as they left the state. Tourists are an important aspect of Florida's economy and thus the role of beaches. The second survey was a telephone survey of Florida residents. The estimated economic impact of tourists while at Florida's saltwater beaches was over $3.4 billion in sales, supporting 142,638 jobs with an annual payroll of $860 million, considering direct and indirect effects. Florida residents spent over $1.1 billion while at the beach, supporting 36,619 jobs with an annual payroll of $240 million. Using the contingent value method (CVM), it was determined that residents were willing to pay $1.31 per day for a visit to the beach.

Bell, F. W. and M. McLean. 1996. The Impact of Manatee Speed Zones on Property Values: A Case Study of Fort Lauderdale, Florida. Florida State University, Department of Economics, Tallahassee, FL; Save the Manatee Club, Maitland, FL.

This study addresses the relationship between manatee speed zones and the market value of property in Fort Lauderdale, Florida. The study used a hedonic property value model that relates the selling price of a piece of property to the property's characteristics including the property's location relative to manatee speed zones. The study found that, contrary to popular belief, manatee speed zones increased property values in Fort Lauderdale, Florida while holding other property characteristics constant. The hedonic property value model found that manatee speed zones increase property values from 15 to 20 percent.

Bell, F. W. and V. R. Leeworthy. 1990. Recreational demand by tourists for saltwater beach days. *Journal of Environmental Economics and Management* 18:189-205.

This analysis addresses tourists (out of state) who come from significant distances for the primary purpose of enjoying the beach resources of Florida. It is argued that those that use the conventional travel cost method do not recognize its potential spatial limitations.

The study concludes that the annual consumer demand by individual tourists for Florida beach days is positively related to travel cost per trip and inversely related to on-site cost per day. Using the on-site cost, the consumer surplus per person per day (i.e., use value) for saltwater beach use was estimated at $34 (in 1984 dollars) without the opportunity cost of time. Using a 10 percent discount rate and an estimated 70 million beach days for the tourist segment of the market for beaches, it was estimated that the asset value (i.e., capitalized value) of Florida's saltwater beaches is $23.74 billion. This does not include the resident part of the asset value.

Bell, F. W. 1992. Actual and Potential Tourist Reaction to Adverse Changes in Recreational Coastal Beaches and Fisheries in Florida. Florida Sea Grant Report TP-64. Florida Sea Grant Program, University of Florida, Gainesville, FL.

This study was designed to test the hypothesis that selected natural resource supply constraints in Florida's coastal zone will moderate the projected growth in Florida tourism. A survey was conducted to determine beach users willingness-to-pay for beach use. The application of the contingent valuation method to estimate use value revealed that tourist saltwater anglers were willing to pay $3.18 per day for their recreational experience.

Bell, F. W. 1995. The Economic Valuation of Saltwater Marsh Supporting Marine Recreational Fishing in the Southeastern United States. Working Paper No. 95-02-02. Florida State University, Department of Economics, Tallahassee, Florida. (Also, see same title in *Ecological Economics* 1997, 21:243-254).

In this study, six proposed methods of wetland valuation are considered and found to be deficient. Following Lynne et al. (1981), a production function approach to valuing the importance of saltwater marshland to marine recreational fisheries has been advocated. To simplify the analysis, the rather complicated production function, which was linked to a demand function for recreational fisheries, was approximated with a Cobb-Douglas form. For 1984, capitalized values of an acre of saltwater to the recreational finfish fishery alone were $6,471 and $981 for the east and west coast of Florida, respectively.

Bell, F. W., M. A. Bonn and V. R. Leeworthy. 1998. Economic Impact and Importance of Artificial Reefs in Northwest Florida. Report prepared for the Office of Fisheries Management and Assistance Service, Florida Department of Environmental Protection, Tallahassee, FL. http://marineeconomics.noaa.gov/Reefs/nwfl.pdf

This study is on the economic impact and economic value of the recreational use of artificial reefs in a five-county area of northwest Florida. Estimates were produced by county, type of user (resident of county versus nonresident of county), boat mode (e.g., own boat, charter boat, party boat or rental boat) and by activity (fishing or diving). For visitors, economic values were estimated using three methods; (1) travel cost demand model, (2) Dichotomous Choice Contingent Valuation Model (probit and logit models) and (3) Turnbull Method – Contingent Valuation. For residents, economic values were estimated using only the two contingent valuation methods that were used for visitors.

Bendle, B. J. and F. W. Bell. 1995. An Estimation of the Total Willingness to Pay by Floridians to Protect the Endangered West Indian Manatee through Donations. Florida Department of Environmental Protection, Economic Analysis Section and Florida

State University, Department of Economics, Tallahassee, FL.

This study uses a variation of one of the existing techniques known as Contingent Valuation by surveying a random sample of 951 Floridians in the winter of 1992/93. The survey elicited information about current donations to several causes, including the plight of the manatee. A contribution continuum method was used for the analysis. This method was reinforced by other empirical techniques. The analysis estimated Floridians' total asset value on protection of the manatee population to be $2.6 billion, or $14.78 per year, per household. Given that there were an estimated 1,800 to 2,000 manatees left in existence, this might be interpreted as meaning that protection of each manatee is conservatively worth $1.5 million to Floridians.

Bhat, M. G. 1999. Valuation of Recreation Benefits of Marine Reserves in the Florida Keys: A Combined Revealed and Stated Preference Approach. Environmental Studies Department, Florida International University, University Park, Miami, FL.

The quality of the coral reefs in the Florida Keys is essential to sustain tourist's interest in the Keys. The recently established marine reserves (MR), are expected to improve the quality and quantity of various attributes of the reefs, including coral and fish abundance and diversity. This study demonstrates how one could measure the recreation benefits of MR-induced quality improvement of the coral reefs. A sample survey was used to obtain data on visitors' travel costs and number of trips under existing reef condition, and their stated preference for trips in response to the MR-related reef improvement. A recreation demand model is derived using the survey data.

Chang, Wen-Huei. 2000. Bibliography of Economic Impacts of Parks, Recreation and Tourism. http://www.msu.edu/user/changwe4/bibli.htm

This bibliography presents diverse applications and concepts of economic impacts studies on recreation and tourism. The sources of this bibliography vary from classic texts to contemporary research. Most of the contemporary studies on economic impacts of recreation and tourism use input-out models, other approaches such as economic base models, econometric techniques, hybrid models, and non-survey methods are also included in this bibliography. Although the primary focus is on park, recreation and tourism related studies, it attempts to cover the major approaches in economic impact analysis, especially the input-output models, for concepts and technical references.

Charbonneau, J. J. 2001. Economic methods used to measure ecological restoration. Abstracts from the 44th Conference on Great Lakes Research, June 10-14, 2001. Great Lakes Science: Making it Relevant. 18 pp.

The primary focus of this paper is to explore the economic methods used to estimate the benefits of restoring the ecosystem components that have been damaged. The examples used come from the Ashtabula River restoration proposal that was submitted to the Corps of Engineers. Traditional economic measures of benefits do not adequately portray all the values associated with a functioning ecosystem. Most economic analyses focus on the goods and services that the public receives and not the infrastructure that produces the goods and services. The many interrelationships between species that are required for a fully functioning ecosystem are

not independently recognized and valued by the public. For example, the value of catching game fish has been the focus of many studies, but seldom has the value of the prey species sought by game fish been estimated. In an economic context, the demand for game fish generates a derived demand for the ecosystem components that produce the game fish. It is fairly easy to estimate the economic value of game fishing. It is very difficult to estimate the economic value of the ecological infrastructure that supports game fish.

Crandall, K. B., B.G. Colby and K. A. Rait. 1992. Valuing riparian areas: A Southwestern case study. *Rivers* 3:88-98.

A brief review of economic techniques, including the travel cost method, contingent valuation method, and local economic impact analysis, is presented and applied to sites with instream flows and riparian ecosystems. The paper focuses on a case study of Arizona's Hassayampa River Preserve. An examination of consumer surplus values for the site, with and without perennial stream flows, reveals a large potential loss of user benefits if streamflows diminish from steady perennial flows to intermittent seasonal flows. Results are useful to policymakers and managers of riparian areas and provide economic data to facilitate decisions regarding streamflows, land use alternatives, and riparian habitat preservation.

Douglas, A. J. and D. A. Harpman. 1995. Estimating recreation employment effects with IMPLAN for the Glen Canyon Dam region. *Journal of Environmental Management* 44:233-247.

This study examines the economic implications of water-based recreational activities at the Lee's Ferry site on the Colorado River. Analyses estimate the job impacts of expenditures for recreation trips. Input-output models of water-based recreational activities were used, and conclude that the outdoor recreation sector of the economy is relatively labor intensive.

Green, G., C. B. Moss and T. H. Spreen. 1997. Demand for recreational fishing in Tampa Bay, Florida: A random utility approach. *Marine Resource Economics* 12:293-305.

An estimation of demand for recreational fishing in Tampa Bay, Florida, can facilitate the environmental management of the bay. A nested random utility (RUM) travel cost model was used to estimate access values to Tampa Bay. Average value of welfare losses per resident angler were calculated at $1.68 per trip for the loss of the bay itself and $3.66 for the loss of both the bay and Pinellas County together (expressed in 1992 dollars). Because of large number of substitute water bodies in the west central part of Florida, considered by the RUM model, the trip values per angler to the bay is relatively low compared to other estimates for angling using less flexible techniques.

Hazen and P. C. Sawyer. 1998. Estimated Economic Value of Resources. Report prepared for the Charlotte Harbor National Estuary Program, North Fort Myers, FL.

In preparation for its Comprehensive Conservation and Management Plan (CCMP), Charlotte Harbor NEP commissioned an evaluation of the economic value of resources within the Charlotte Harbor watershed. The study estimated consumer surplus and total income values associated with the natural resources of the Charlotte Harbor watershed. Non-market values of the watershed were estimated using benefits transfer. IMPLAN multipliers were used to estimate total income for the region. The

study found that the Charlotte Harbor National Estuary provides about $1.8 billion per year in net value to recreators and Florida households, and was used to produce about $3.2 billion per year in income to the area.

Koberstein, P. 1997. What's a river worth? River Values, 8-12. *American Rivers*.

This article supports the claim that revitalized and protected rivers can produce quantifiable economic benefits. The Missouri, Columbia, and Blackfoot Rivers provide examples of how rivers can attract new small businesses and recreation and tourism dollars to communities. The purpose is to show that rivers provide economic benefits beyond those generated by industrial uses.

Leeworthy, V. R. and J. M. Bowker. 1997. Non-market Economic User Values of the Florida Keys/Key West. June 1995 - May 1996. National Oceanic and Atmospheric Administration, Strategic Environmental Assessments Division, Silver Spring, MD; U.S. Forest Service, Outdoor Recreation and Wilderness Assessment Group, Athens, GA.

This study estimated the use value of various forms of outdoor recreation involving visitors to the Florida Keys/Key West area. Use values were estimated from the basic travel cost model without the value of time using statistical techniques called the truncated Poisson and truncated negative binomial. These values were obtained from a sample of 4,360 visitors over the l995-96 period. Day-trippers to the area were very sensitive to price while others, except Hispanics, were not highly sensitive to price with respect to a reduction. The total annual use value for various recreational activities was estimated at about - $.9 billion dollars. When capitalized at a discount rate of 3%, the asset or capitalized value was about - $30.1 billion for just the visitor segment of use value in the Florida Keys/Key West.

Leeworthy, V. R. 1991. Recreational Use Value for John Pennekamp Coral Reef State Park and Key Largo National Marine Sanctuary, Winter, 1988 - Spring, 1989. National Oceanic and Atmospheric Administration, Rockville, MD.

The purpose of this study was to estimate the use value of John Pennekamp Coral Reef State Park and Key Largo National Marine Sanctuary in Florida, which provides recreational activities including diving, boating and other park-related activities. A sample of 342 visitors (i.e., residents and out-of-state tourists) to this area was analyzed using data from 1989. The travel cost method was used to estimate the use value of this area with and without the value of time. The author feels that a realistic estimate of use value for the park is between $285 and $426 per day or an average of $356, in l989 dollars.

Lin, C-T. J. and W. J. Milon. 1995. Contingent valuation of health risk reductions for shellfish products, In J. A. Caswell (ed.) Valuing Food Safety and Nutrition. Westview Press, Boulder, CO.

Introduces the contingent valuation method for valuing the reductions in heath risks associated with the consumption of shellfish products (in the Southeastern U.S., including Florida). The purpose of the analysis was to investigate 1) the relationship between valuation and the magnitude of foodborne risk reductions and 2) whether risk information presented in relative terms and in absolute terms produces different valuation responses. A survey of 1,094 respondents in the Southeast was conducted in early 1990 that asked respondents about their oyster consumption and preferences. The

estimated mean WTP to reduce the heath risk from eating oysters relative to the health risk associated with eating chicken ranged from $0.54 to $0.73 depending on the question format and treatment of outliers. The estimated mean WTP to reduce the absolute heath risk from eating oysters ranged from $0.54 to $0.80 depending on the treatment of outliers and the level of absolute risk reduction considered.

Liu, B. C., N. Christiansen and J. Jaksch. 1980. Measurement of the socioeconomic impact of lake restoration: An assessment model employing a benefit/cost cross-impact probabilistic approach. *American Journal of Economics and Sociology* 39:227-236.

A number of lake restoration demonstration projects have been launched by the Environmental Protection Agency as a result of Public Law 92-500. To evaluate the cost-effectiveness of these public investment projects requires the development of an assessment model. The proposed Benefit/Cost Cross-Impact Probabilistic Approach is one attempt at assessing the interdependent SE and environmental impacts of the lake restoration project over time, both quantitatively and qualitatively, so that various changes brought about by the project can be investigated and evaluated in two comparative stages for three points in time: before, during, and after project implementation.

Loomis, J. B. 1989. A bioeconomic approach to estimating the economic effects of watershed disturbance on recreational and commercial fisheries. *Journal of Soil and Water Conservation* 44:83-87.

This study estimates changes in value of recreational and commercial fisheries due to timber harvesting and road building in two national forests. A travel-cost method is applied to bioeconomic models of the fisheries in order to examine incremental changes in economic value under different levels of watershed disturbance. Results for the Siuslaw National Forest indicate that the loss of salmon and trout due to clear-cutting on 87 acres of forestland resulted in a $2 million dollar economic loss to recreational and commercial anglers over a 30-year period. Results indicate that timber harvesting in the Porcupine-Hyalite Wilderness study area in Montana resulted in a loss of $3.5 million in trout fishing over a 50-year period.

Loomis, J., P. Kent, L. Strange, K. Fausch and A. Covich. 1999. Measuring the total economic value of restoring ecosystem services in an impaired river basin: Results from a contingent valuation survey. *Ecological Economics* 33:103-117.

This paper quantifies willingness to pay for restoration of five ecosystem services: dilution of wastewater, natural water purification, erosion control, habitat for fish and wildlife, and recreation, along a 45-mile stretch of the South Platte River near Denver, Colorado. Household surveys were used to determine willingness to pay by giving individuals the hypothetical option to pay for protection of ecosystem services through higher water bill costs. Results indicate that those surveyed would pay an average increase of $21 a month ($252 annually) for the five ecosystem services.

Loomis, J. B. and G. L. Peterson. (Date unknown). Economic Information in River Recreation Management. U.S. Fish & Wildlife Service and U.S. Forest Service, Fort Collins, CO.

This study presents a guide for identifying differences between financial – measurable revenue/sales value, and economic – intrinsic, option, existence and bequest values, of a river.

Identified are economic measures that can be used to address various river management issues. A graphical analysis is used to demonstrate the need for economic efficiency measures, such as willingness to pay and consumer surplus, when evaluating economic Benefit Cost Analyses or in National Forest Planning. The study concludes with a discussion of two commonly used techniques to measure willingness to pay for river recreation and off-site preservation values of rivers.

McDonald, L. A. and G. M. Johns. 1999. Integrating social benefit cost accounting into watershed restoration and protection programs. *Journal of the American Water Resources Association* 35:579-592.

Successful watershed management requires consideration of multiple objectives and the efficient use of scarce public and private resources. One way to address these multi-faceted issues is through Social Benefit-Cost Accounting (SBCA). SBCA is a systematic method of addressing complex social and economic issues relevant to proposed watershed management projects. Benefits of using this technique include: benefits and costs of watershed projects are better understood; politically sensitive issues tend to be put into perspective; and stakeholders' interests are placed on a level playing field. An example from Bogota, Colombia demonstrates how SBCA can be used to value the benefits and costs of a proposed project. By addressing the benefits and costs to all stakeholders, the design of watershed management programs can be improved to achieve goals in a cost-effective manner.

Milon, J. W. 1988. Travel cost methods for estimating the recreational use benefits of artificial marine habitat. *Southern Journal of Agricultural Economics* July:87-101.

Compares and discusses the single and multi-site travel cost demand models used in the study of the economic value of artificial reefs in Dade County, Florida. Theoretical concerns about price and quality effects of substitute sites, corner solutions in site choice and econometric estimation are considered. Results from the case study indicate that benefit estimates are influenced by the way these concerns are addressed, but relatively simple single site models can provide defensible estimates. Practical limitations on data collection and model estimation are also considered.

Milon, J. W. 1989. Contingent valuation experiments for strategic behavior. *Journal of Environmental Economics and Management* 17:293-308.

Elaborates on the contingent valuation methodology used in the study of the economic value of artificial reefs in Dade County, Florida. The paper summarizes the results of an experiment that tested for the effects of variations in the Dade County mail survey form on respondent's willingness to pay for artificial reef use and their ability and willingness to disclose their personal valuation.

Milon, J. W. and A. Rimal. 1997. Substitution, Sequencing and Starting Point Effects in the Valuation of Composite Environmental Goods. Food and Resource Economics Department Staff Paper, University of Florida, Gainesville, FL.

Presents the results from a contingent valuation experiment with survey data from the Indian River Lagoon National Estuary Program and the Coastal Resources Survey. The study estimated willingness to pay for various combinations of six different environmental programs: sea grass restoration and protection, sea turtle protection, coral reef restoration and protection, wetland

conservation measures, a wetland restoration trust fund, and stormwater controls. The mean annual willingness to pay for the individual Indian River Lagoon environmental programs ranged from $58.71 to $112.05 and from $79.25 to $405.02 for the combined programs. Similarly, the mean annual willingness to pay for the individual Coastal Resources Survey environmental programs ranged from $1.36 to $65.39 and from $46.61 to $216.90 for the combined programs.

National Park Service. 1995. Economic Impacts of Protecting Rivers, Trails, and Greenway Corridors: A Resource Book. National Park Service, Rivers, Trails, and Conservation Assistance Program, Washington, D.C.

This publication is a "how-to" guide that instructs the reader in ways to apply economic rationale and related analyses to support river, trail and greenway projects. Sections address real property values, expenditures by residents, commercial uses, tourism, agency expenditures, corporate relocation and retention, and public cost reduction and benefit estimation. Also included are instructions on how to use a consumer price index and a sample survey for economic studies on property values and user spending.

Qui, Z. and T. Prato. 2001. Physical determinants of economic value of riparian buffers in an agricultural watershed. *Journal of the American Water Resources Association* 37:295-303.

The economic value of riparian buffers presented in this study is based on reducing agricultural nonpoint source pollution and providing stream habitat protection. Physical characteristics (such as hydrologic, topographic, land use, and soil attributes) of the Coldwater Creek watershed, Missouri were studied to determine areas of the watershed where construction of riparian buffers would be most cost-effective. Geographic information systems (GIS) were used to identify these target areas. Findings indicate that riparian buffers have the greatest benefit along streams and rivers in crop production areas. Areas where buffer zones cover longer stream stretches and more acreage tend to have greater benefits than those buffer zones that cover shorter stretches and less acreage, respectively.

Shivlani, M. P., D. Letson and M. Theis. 2003. Visitor preferences for public beach amenities and beach restoration in South Florida. *Coastal Management* 31:367-385.

Coastal erosion threatens many sandy beaches and the ecological, economic, social and cultural amenities they provide. The problem is especially chronic in South Florida. A frequent solution for beach restoration involves sand replacement, or nourishment, but is temporary, expensive, and has usually been funded by governmental sources. However, as such agencies reduce their share and require more local funding, beach nourishment must rely on other funding sources, including beach recreationists. This study characterizes three South Florida beaches and probed visitor willingness-to-pay for beach nourishment. It was found that even beaches within close proximity attract different user types. Users are amenable to higher fees if they lead to greater resource protection.

Southern California Beach Valuation Project - NOAA. http://marineeconomics.noaa.gov/SCBeach/welcome.html

A study initiated by NOAA for the purpose of estimating the market and nonmarket values of recreation uses of Southern California Beaches, beach visitation, the effect of beach attributes, substitution issues, and profiles of beach users on values.

Spurgeon, J. 1999. The socio-economic costs and benefits of coastal habitat restoration and creation. Proceedings of an International Workshop on the Rehabilitation of Degraded Coastal Systems, January 19-24, 1998, no. 20, 133 pp. Special publication. Phuket Marine Biological Center, Phuket, Thailand.

As the number of coastal restoration initiatives increases, so too does the need and ability to determine their true socio-economic costs and benefits. Habitat restoration and creation is certainly in vogue, but does it represent an efficient use of resources? It is only after such initiatives have been undertaken that their full costs can be determined with any accuracy. Costs occur from the initial scoping stages, through the construction phase and continue in the form of on-going management and operational monitoring costs. 'Opportunity costs' (i.e., the benefits foregone from an alternative use) must also be included. Predicting whole life restoration costs is inherently problematic given the complex and dynamic nature of the environment and the many uncertainties involved. Equally, assessing the true socio-economic benefits of restoration schemes is complex and is only now becoming possible as the outcomes of current schemes begin to unfold. Furthermore, the techniques available to place monetary values on the environment are continuing to improve, enabling more comprehensive and accurate estimates of the value of the accruing benefits. Such benefits include, for example, direct (e.g., products and recreation) and indirect (e.g., physical protection) uses, as well as non-use (e.g., existence) values. This paper provides an objective overview of the potential socio-economic costs and benefits relating to the restoration and creation of a diverse range of coastal habitats. The habitats examined include coral reefs, mangroves, sea-grasses, salt marshes, sand dunes, mudflats and lagoons. Factors affecting the magnitude of costs and benefits are highlighted, and the potential significance of different components of costs and benefits for each habitat type are identified. The appropriateness and value of using cost-benefit analysis to help assess and improve the effectiveness of coastal habitat restoration and creation is also discussed.

Spurgeon, J. 1998. The socio-economic costs and benefits of coastal habitat rehabilitation and creation. *Marine Pollution Bulletin* 37:373-382.

This paper provides a comprehensive over-view of the merits and limitations of using an economics-based approach to assess and implement initiatives for coastal habitat rehabilitation and creation. A review of the literature indicates that habitat rehabilitation/ creation costs vary widely between and within ecosystems. For coral reefs, costs range from US$ 10,000 to 6.5 million/hectare (ha); for mangroves US$ 3000-510,000/ha; for sea-grasses US$ 9000-680,000/ha and for salt marshes US$ 2000-160,000/ha. A review of the economic benefits derived from various coastal habitats based on a 'Total Economic Value' approach (i.e., accounting for direct and indirect uses, and 'non-uses') reveals that many thousands of US$ per hectare could ultimately accrue from their rehabilitation/creation. The paper concludes that despite its limitations, the 'benefit-cost analysis' framework can play an important role both in assessing the justification of coastal habitat rehabilitation/creation initiatives, and by helping to improve the overall effectiveness of such initiatives.

Spurgeon, J. 2001. Improving the economic effectiveness of coral reef restoration. Proceedings of the International Conference on Scientific Aspects of Coral Reef Assessment, Monitoring, and Restoration. *Bulletin of Marine Science* 69:1031-1045.

This paper provides a brief overview of the economic costs and benefits of coral reef restoration and considers the potential application of benefit-cost analysis. Three coral restoration case studies indicate that restoration costs can vary enormously, from around US$10,000 ha^{-1} to US$5 million ha^{-1}. A brief review of the economic benefits of coral reefs based on a 'total economic value' approach (i.e., accounting for direct and indirect uses, and 'non-uses'), reveals that potentially many thousands of US$ per hectare could accrue from reef restoration. Various parameters are identified which dictate the value of coral benefits, and those factors that can be manipulated through restoration to enhance coral benefits are highlighted. The paper concludes with a number of recommendations. There is scope for greater application of a 'benefit-cost analysis' framework to assess the justification for restoring coral reefs and to improve the overall effectiveness of such initiatives.

Stronge, W. B. and R. R. Schultz. 1997. Broward County Beaches: An Economic Study 1995-96. Technical report 97-03. Prepared for the Broward County, Department of Natural Resource Protection, Biological Resources Division, Ft. Lauderdale, Florida by Regional Research Associates, Inc., Boca Raton, FL.

This report developed estimates of both the market and non-market economic values of Broward County beaches for year 1995-96. Market economic values estimated included direct expenditures, indirect expenditures, tax revenues, and the number of jobs in Broward County, Southeast Florida and all of Florida. In addition, property values related to proximity to the beaches are also estimated. Non-market economic use values are estimated using a contingent valuation question. Overall the study estimated that there were 7,169,447 visits to Broward County beaches that generated a total annual non-market economic user value of $29,677,770. Per visit values, in 1998 dollars, were reported for Delray Beach ($4.94), Anna Marie Island ($41.2) and Captiva Island ($7.00)

Swart, J. A., H. J. Van Der Windt and J. Keulartz. 2001. Valuation of nature in conservation and restoration. *Restoration Ecology* 9:230-238.

Valuation of nature is an important aspect of nature conservation and restoration. Understanding valuation in a broad sense may contribute to conservation strategies since it may lead to better support from society. In this article we propose a model of valuation with respect to conservation and restoration of nature. According to the model, valuation of nature can be characterized by a "valuation approach," consisting of ecological, ethical and aesthetic perspectives. Such an approach includes scientific and normative aspects and leads to a particular claim of conservation. In this paper we discuss different perspectives, and accordingly, we sketch three main types of these valuation approaches. Political and policy issues with respect to nature conservation and restoration are considered in terms of this model.

3. Research on Stakeholders' Values, Attitudes and Satisfaction Ratings

Bright, A. D., S. C. Barro and R. T. Burtz. 2002. Public attitudes toward ecological restoration in the Chicago Metropolitan Region. *Society and Natural Resources* 15:763-785.

This study examined the relationship between attitudes toward urban ecological restoration and cognitive (perceived outcomes, value orientation, and objective knowledge), affective (emotional responses), and behavioral factors using residents of the Chicago Metropolitan

Region. Positive and negative attitudes were both related to perceived outcomes of ecological restoration. In addition, positive attitudes were related to values while negative attitudes were related to emotions. Attitudes of high and low importance groups were connected to perceived outcomes of ecological restoration; however, attitudes of the high importance group were also related to values, emotions, and behavior. Positive and negative attitude groups differed on perceived outcomes, basic beliefs, knowledge, and behavior. Implications lie in understanding of complex attitudes toward natural resource issues and improved communication efforts to influence or educate the public.

Cofer-Shabica, S.V., R. E. Snow and F. P. Noe. 1990. Formulating policies using visitor perceptions of Biscayne National Park and Seashore, pp. 235-254, In P. Fabbri (ed.), Recreational Uses of Coastal Areas. Kluwer Academic Publishers, Norwell, MA.

Visitor surveys were handed to randomly selected visitors to the park in the winter and summer and returned by mail. A mail-out survey was sent to registered boat owners in Dade County. From a park management perspective, Biscayne's data suggest a need for sensitivity to expectations that different ethnic groups brought to the Park when designing services and programs. Data also suggested addressing issues of whether marine recreational areas should have increased development and formal control to maximize visitor satisfaction, or remain undeveloped.

Grese, R. E., R. Kaplan, R., R. L. Ryan and J. Buxton. 2000. Psychological benefits of volunteering in stewardship programs, pp. 265-280, In Gobster, P. H. and R. B. Hull (eds.), Restoring Nature. Island Press, Washington, D.C.

This study explores people's motivations for and benefits derived from volunteer stewardship efforts. Interviews were conducted with Chicago-area participants in the Volunteer Stewardship Network and with leaders of several volunteer programs throughout Michigan. A survey instrument was developed based on these interviews and was distributed to volunteers of different organizations. Volunteers were highly motivated by a desire to help the environment and learn new things. They also may benefit from opportunities to reflect and seek spiritual fulfillment as well as to develop friendship and social networks. Programs that pay attention to these considerations may fare better in attracting and retaining volunteers, issues that are critical to the long-term success of any ecological restoration effort.

Leeworthy, V. R. and P. C. Wiley. 1996. Importance and Satisfaction Ratings by Recreating Visitors to the Florida Keys/ Key West, June 1995 - May 1996. National Oceanic and Atmospheric Administration, Strategic Environmental Assessments Division, Silver Spring, MD.

This report provides an easy-to-use analytical framework for assessing the ratings by visitors in terms of importance and satisfaction with 25 selected natural resource attributes, facilities, and services of the Florida Keys. For 11 of the 25 items, comparisons were made between visitors' current satisfaction ratings and their ratings of these items five years prior. Statistical tests were conducted to highlight significant differences.

Milon, J. W., C. M. Adams and D. W. Carter. 1988. Floridians' Attitudes about the Environment and Coastal Marine Resources. Florida Sea Grant Technical Paper 95, University of Florida, Gainesville, FL.

Provides a description of a research project designed to assess Floridians' attitudes about the environment and coastal marine resources and their support for programs to protect these resources. A statewide survey of nearly 1,800 adult residents elicited information on: preferences for expenditures on various state programs, attitudes about the environment and specific marine resources, participation in coastal recreation activities, and general socioeconomic and demographic characteristics. The survey results indicate that Floridians are broadly committed to an "environmentally oriented world view." They are concerned about the health of coastal resources and the adequacy of existing programs to protect these resources. While there were differences in the intensity of these attitudes across respondents, the consistency of the responses indicates that these attitudes are not random and idiosyncratic, but rather, reflect the personal philosophies, interests, and experiences of the respondents.

Schroeder, H. W. 2000. The restoration experience: Volunteers' motives, values, and concepts of nature, pp. 247-264, In Gobster, P. H. and R. B. Hull (eds.), Restoring Nature. Island Press, Washington, D.C.

The goal of this study was to learn more about restoration volunteers, what their work means to them and what specific motives, values, and rewards have induced them to give so many hours of their free time to restoration activities. The primary source of material for this study was the periodic newsletters distributed by many of the individual stewardship groups. These newsletters, written and edited by the volunteers themselves, contain many passages that express who the volunteers are, what they are trying to achieve, why they are drawn to this kind of work, and what rewards they experience in the course of doing their work. Results suggest that the high level of motivation and enthusiasm for restoration volunteerism stems from three interacting factors: 1) the sense of urgency the feel about the fragility of nature and the impending loss of native sites and species, 2) their belief that they can make an important and real difference in preventing this loss, and 3) the ability to see tangible progress and results from their efforts in a fairly short time span.

Vining, J., E. Tyler and B. Kweon. 2000. Public values, opinions, and emotions in restoration controversies, pp.143-161, In Gobster, P. H. and R. B. Hull (eds.), Restoring Nature. Island Press, Washington, D.C.

This study investigates public values, opinions, and emotions related to ecological restoration. An analysis of new articles and other public documents regarding the Chicago restoration controversy is conducted to develop a comprehensive list of value-based arguments for and against restoration. This information is used to develop and implement a survey of Chicago metropolitan residents' perceptions of restoration practices, as well as their decisions and emotional reactions regarding a restoration scenario in Chicago. Results of this study suggest that ecological restoration specialists, public land managers, decision makers, and social scientists interested in human-environment interactions have a lot to learn from average citizens. Survey respondents strongly identified the need to inform and involve the public in restoration activities, to frame compromise solutions, and to proceed judiciously.

4. Commercial Fishing: Human Dimensions Research

Adams, C. A. 1990. Economic Activities Associated with the Commercial Fishing Industry in Monroe County. Staff Paper SP 92-27. Food and Resource Economics Department, IFAS, University of Florida, Gainesville, FL.

The commercial fishing industry represents an important source of revenue for Monroe County, Florida. This paper estimates (a) economic activity, (b) earnings, and (c) employment generated by the commercial fishing industry in 1990. In 1990, commercial fishermen landed 19.7 million pounds of finfish, shellfish, and other aquatic organisms, valued at $48.4 million dockside. The total wholesale value of the various products landed by the commercial fishing industry in Monroe County was $64 million. The estimated economic impact generated includes economic activity - $90.4 million, earnings - $32.2 million, and employment - 2,230 FTEs.

Anderson, E. 1989. Economic benefits of habitat restoration: Seagrass and the Virginia hard-shell blue crab. *North American Journal of Fisheries Management* 9:140-149.

Since the early 1960s, water pollution has caused the disappearance of much of the seagrass (predominantly eelgrass *Zostera marina*) and other submerged aquatic vegetation in Chesapeake Bay. Seagrass beds appear to serve as preferred habitat for the blue crab *Callinectes sapidus* during early stages of its life history, and there is a statistically significant relationship between the abundance of submerged aquatic vegetation and catch per unit of effort in the Virginia hard-shell blue crab fishery. Virginia seagrass beds might be partially or fully restored through a combination of pollution abatement and replanting. I developed a simple simulation model with minimal data requirements to generate rough estimates of some of the economic benefits that would accrue from seagrass restoration. The estimated net economic benefit to Virginia hard-shell blue crab fishermen of full seagrass restoration is about US $1.8 million per year, and additional annual benefits of about $2.4 million should accrue to U.S. hard-shell blue crab consumers.

Bell, F. W. 1984. Application of Wetland Valuation Theory to Commercial and Recreational Fisheries in Florida. Florida Sea Grant Report No. 95, Florida Sea Grant College Program, University of Florida, Gainesville, FL. (Also see *Ecological Economics* 21 (l997) 243-254 for the recreational segment and the *Journal of Economic Research* 3 (l998) 1-20 for the commercial segment of this report in condensed form).

This paper is concerned with placing an economic value on the contribution of wetlands in supporting both the recreational and commercial marine fisheries in Florida. Production functions linking fishing effort and wetlands to fishery value are used to demonstrate the marginal productivity theory approach to valuing wetlands. Chapter 2 reviews the biological and economic functions of wetlands. Chapter 3 reviews methods for economic valuation of wetlands. Chapter 4 presents the marginal productivity theory approach to valuing wetlands. Chapter 5 examines marginal productivity theory applied to Florida's east and west coast marine fisheries; and Chapter 6 estimates the fishery component of wetlands and the calculated asset values of the wetland resources under alternative discount rates.

NOAA. 1996. An Appraisal of the Social and Cultural Aspects of the Multispecies Groundfish Fishery in New England and the Mid-Atlantic Regions. National Marine Fisheries Service report prepared by Aguirre International under Contract Number 50-DGNF-5-00008 between NOAA and Aguirre International. http://www.nefsc.noaa.gov/read/socialsci/cultural-aspects/50-DGNF-5-00008.pdf

The goals of this study were: (a) to identify fishery-dependent communities throughout the Northeast Region, (b) to provide information

on the demographics and numbers of fishermen, fishing craft, and persons involved in fishery-related industries by community, county, and state, (c) to identify existing social science data bases and describe social issues which should be considered in Phase II, and (d) to develop a classification system that would aid in predicting the social impacts of changing fishery regulations on fishery-dependent communities.

Thorhaug, A. 1990. Restoration of mangroves and seagrasses - economic benefits for fisheries and mariculture, pp. 265-281, In Berger, J. J. (ed.), Environmental Restoration: Science and Strategies for Restoring the Earth. Papers from Restoring the Earth Conference, January 1988. Island Press, Washington, D.C.

This paper reviews mangrove and seagrass restoration in terms of its ecological and economic benefit to fisheries and aquaculture. In the tropics and subtropics, mangroves are a critical habitat in the intertidal zone and on the upper shoreline. Seagrasses are a critical habitat from the intertidal zone seaward to the coral reef. Mangroves and seagrasses serve parallel functions as nursery grounds and critical habitats for fish, as a direct food source for fish, and as surfaces for growth of epizonts, which serve as food for fish. This paper contains a review of coastal restoration efforts, including an assessment of development impacts on mangroves and seagrasses. Management solutions to nearshore fisheries problems are also discussed, and general recommendations for using seagrass and mangrove restoration to sustain fisheries are made.

5. Education and Outreach Research

Bowler, P. A., F. G. Kaiser and T. Hartig. 1999. A Role for Ecological Restoration Work in University Environmental Education. *Journal of Environmental Education* 30:19.

The effects of ecological restoration field work and in-class instruction on students' ecological behavior, environmental attitudes, and perceptions of restorative qualities in a natural environment were studied in 3 classes of university undergraduates (N = 488). In 1 class, students (n = 145) carried out ecological restoration work on 8 field trips. Students in 2 control classes (n = 157; n = 186) each made only 1 field trip, to a site where the other class had done restoration work, but did no restoration work. In 1 of the control classes, data were collected from 5 subgroups at different points in the course to examine the effects of cumulating in-class instruction. Ecological restoration work positively affected environmental attitudes and ecological behavior, but within the attitude measures it affected only ecological behavior intention and not environmental knowledge or environmental values. In-class instruction was associated with perceived restorative qualities in the study site; perceptions of Being Away, Coherence, and Fascination increased over the course of instruction.

Burton, S., C. Vickery and K. Weiss. 1994. Public Education Survey for the Indian River Lagoon, National Estuary Program. FAU/FIU Joint Center for Environmental and Urban Problems. U.S. EPA (National Estuary Program), St. John's River Water Management District, FL.

The Indian River Lagoon (IRL) spans some 156 miles along Florida's central east coast. It is listed as an estuary of national significance and included in the National Estuary Program. Results from the survey provided a basis for determining a desirable and acceptable approach to educating the public about the environmental issues of concern and their potential solutions as they relate to the IRL. Furthermore, the survey may also be used to better understand how to target various audiences within the general population for public information and

education. Survey information was obtained through telephone interviews with 407 randomly selected residents from the five counties that form the IRL system, Brevard, Indian River, Martin, St. Lucie, and Volusia.

Covington, W. W., P. Z. Fule, T. M. Alcoze and R. K. Vance. 2000. Learning by doing - Education in ecological restoration at Northern Arizona. *Journal of Forestry* 98: 30-34.

In the Southwest, where forest ecosystems have been widely degraded, Northern Arizona University has begun offering an interdisciplinary focus on forest restoration. A course in the principles of restoration addresses such issues as reference conditions, the impact of indigenous peoples on the landscape, and natural variability versus accelerated anthropogenic change. An applications course includes hands-on experience in restoring a ponderosa pine forest and calculating the costs of implementation. Through practical study and applied research, the program is intended to support the preparation of future participants in a growing field.

Geist, C. and M. Galatowitsch. 1999. Reciprocal model for meeting ecological and human needs in restoration projects. *Conservation Biology* 13:970-979.

Research presented concerns a model for ecological restoration that focuses on human relationships to the environment in order to overcome obstacles of time, cost, and labor that often hamper the success of habitat improvement projects. Topics addressed include community participation in restoration projects, and the dynamic relationship between human involvement and project success.

United States General Accounting Office (USGAO). 1995. Restoring the Everglades: Public Participation in Federal Efforts. Resources Community, Economic Development Division. USGAO, Washington, D.C., RCED-96-5.

This document reviews the implications of involving non-federal entities (stakeholders) in the policy development process for specific environmental concerns in South Florida. Constraints imposed by external factors often dictate the extent to which federal agencies can involve nonfederal stakeholders in their activities. Furthermore, although consensus among federal and nonfederal stakeholders is desirable, restoration efforts are inherently contentious, and consensus on solutions that directly affect various interests may not be attainable. In addition, stakeholders express dissatisfaction with the process for nonfederal involvement. In many cases, a public policy decision cannot be disassociated from stakeholder dissatisfaction with the outcome of the process. Therefore, the most that federal agencies may be able to achieve is an open airing and full consideration of all views within the constraints imposed by external factors.

6. Socio-Cultural and Anthropological Research

Wiedman, D. 1976. The individual and innovation in the process of socio-cultural adaptation to frontier situations. *Papers in Anthropology,* University of Oklahoma, Norman, OK, 17:107-116.

This paper outlines a process of human adaptation to new environments. Ethnographic fieldwork and historical data from the Chokoloskee Bay area of Southwest Florida are used in a comparative analysis of three frontier areas of the World. This process is suitable for understanding the various cultural groups as they adapt to South Florida environments.

For example, their settlement patterns, use of resources and technological innovation.

7. Coastal Restoration and Property Damage Reduction

FEMA. Federal Programs Offering Non-Structural Flood Recovery and Floodplain Management Alternatives. Federal Emergency Management Agency Publication #102.

Information to local cooperators and other interested parties about federal programs that support a non-structural approach to floodplain management. Programs are grouped by three primary non-structural strategies: (1) acquisition, relocation, elevation, and flood-proofing of existing structures; (2) rural land easements and acquisitions; and (3) restoration of wetlands.

Loomis, J. B. 1994. Determining Benefits and Costs of Urban Watershed Restoration: Concepts, Techniques and Literature Review. Colorado State University, Department of Agricultural and Resource Economics, Fort Collins, CO.

This study details the economic benefits that natural stream channel restoration can provide, including flood damage reduction, cost savings, and enhancement of the natural environment. Techniques for estimating flood damage reductions are identified.

Olsen, J. R. and P. A. Beling. 1998. Input-output economic evaluation of system of levees. *Journal of Water Resources Planning & Management* 124:237-246.

Presented is a method to estimate the economic effects of flooding over a region of interacting floodplains and other lands by incorporating a Leontief economic input-output model. Authors discuss how the model is used, how to relate flood probabilities to output, and provide application examples.

Property Acquisition Handbook for Local Communities. Federal Emergency Management Agency Publication #317. http://www.fema.gov/fima/handbook/

The Property Acquisition Handbook for Local Communities is a "how to" guide to help communities work through one specific hazard mitigation alternative known as property acquisition (also referred to as "buyout"). The Handbook contains four parts, representing the four phases of the property acquisition process.

8. Effects of Coastal Restoration on Property Values

Brookshire, D. S., M. Thayer, W. D. Schulze and R. C. d'Arge. 1982. Valuing public goods: A comparison of survey and hedonic approaches. *The American Economic Review* 72:165-77.

This 1979 study on the economic benefits of air pollution control includes the empirical results obtained from two experiments to measure the health and aesthetic benefits of air pollution control in the South Coast Air Basin of Southern California. Each experiment involved the same six neighborhood pairs, where the pairings were made on the basis of similarities in housing characteristics, socio-economic factors, distances to beaches and services, average temperatures, and subjective indicators of housing quality. The elements of each pair differed substantially only in terms of air quality. Data on actual residential property transactions and on stated preferences in air quality were collected. The results indicate that air quality deterioration in the Los Angeles area has had substantial negative effects on housing prices and that these effects are comparable in magnitude to what

people say they are willing to pay for improved air quality.

Brown, P. J. and C. J. Fausold. 1998. A Methodology for Valuing Town Conservation Land. Lincoln Institute of Land Policy Working Paper. http://www.lincolninst.edu/pubs/pub-detail.asp?id=127

This paper presents a methodology for rating existing or potential conservation land according to ten criteria weighted to reflect the needs of the local community in which the land is located. The ratings may be used to determine priority for public acquisition. The methodology may also be used to establish a dollar "replacement value" for an existing parcel of conservation land, reflecting both its market value as well as its value for other public interests such as conservation, recreation, views, or resource protection. The replacement value may be used as a starting point in negotiations for compensation in the event that the parcel is removed from conservation land status through eminent domain or other mechanism.

Epp, D. J. and K. S. Al-Ani. 1979. The effect of water quality on rural non-farm residential property values. *American Journal of Agriculture and Economics* 61:529-534.

The authors use real estate prices to put a value on improvements in the water quality of small rivers and streams in Pennsylvania. Specific goals are: 1) to estimate the relationship between water quality and value of residential properties adjacent to small rivers and streams, and 2) to estimate the effect of various components of water quality, such as acidity, dissolved oxygen, biochemical demand, and nitrate/phosphate levels on the value of properties adjacent to small streams. Results indicate that water quality has a positive correlation with economic value of adjacent properties.

Kulshreshtha, S. N. and J. A. Gillies. 1993. Economic evaluation of aesthetic amenities: A case study of river view. *Water Resources Bulletin* 29:257-266.

This study employs market and non-market valuation techniques to estimate the value of aesthetic amenities that the South Saskatchewan River provides to residents of Saskatoon, Canada. Two major areas in which greater aesthetic amenities provide greater value are identified: ownership of property, and rental of private property. Findings indicate that aesthetic amenities provided by the river amounted to approximately 10 percent of the annual economic contribution the South Saskatchewan River makes to the city.

Leefers, L. and D. M. Jones. 1996. Assessing Changes in Private Property Values Along Designated Natural Rivers in Michigan. Michigan State University, Department of Forestry, Lansing, MI.

This comprehensive study examines property values and selling prices along areas with 'Natural River' designation in Michigan. The results reveal that property values and selling prices are indeed higher along areas with 'Natural River' designation. The study details the procedures used as well as the methods for data evaluation.

Rosner, M. H. and L. R. Barrows. 1976. Who Pays for the Wild Rivers?: An Analysis of the National Park Service's Wild Rivers Program on Property Taxes in Washburn County, (Cooperative Extension Service no. 110). University of Wisconsin, College of Agricultural and Life Sciences, Madison, WI.

Concern over land acquisition by the National Park Service (NPS) in Washburn County,

Wisconsin is addressed. It is generally believed that higher property taxes result when land is removed from the tax base. However, the authors' findings suggest that the impact on property taxes of removing public lands from the tax base is negligible – an increase of only $0.01 per $1000.00. This small increase in property tax is because the tax-loss associated with NPS land acquisition was mostly made up through small increases in income and sales taxes and additional sources of revenue statewide instead of through local property tax increases.

9. Human Dimensions Benefits of Improved Water Quality

Alaouze, C. M. 1999. An economic analysis of the eutrophication problem of the Barwon and Darling Rivers in New South Wales. *Australian Economic Papers* 38:51-63.

This paper focuses on the economic implications of water quality on recreation values. An example of a 1000-km, toxic blue-green algae bloom which afflicted the Barwon and Darling Rivers in 1991 is used for discussion. This bloom occurrence was attributed to increased water use for irrigation, drought, and nutrient pollution (mainly phosphorus) from sewage treatment plants and other point sources. The cost of pollution function is unknown, but results suggest that if marginal costs of phosphorus removal are low, the equilibrium level of phosphorus at each location is likely to be below that which reduces the recreational value of the rivers.

Gramlich, F. W. 1977. The demand for clean water: The case of the Charles River. *National Tax Journal* 30:183-194.

A survey of 165 families' willingness to pay in the metropolitan area of Boston finds that costs and benefits of swimmable water in the Charles River are nearly equal. Determinants of willingness to pay were isolated using regression analysis. An estimate of aggregate benefits from improving water quality was developed from the regressions and compared to resource costs. The range of estimates for aggregate benefits is $8.8-21.9 million, with an average of $15.4 million, with total aggregate costs at $16.7 million. Findings from interviews and questionnaires indicate that family income, education, proximity of home and workplace to the river, graduate student status, and probability of future residence were all positively correlated with willingness to pay. A variety of independent variables were considered for analysis.

Magat, W. A., J. Huber, W. K. Viscusi and J. Bell. 2000. An iterative choice approach to valuing clean lakes, rivers, and streams. *Journal of Risk and Uncertainty* 21:7-43.

This article introduces an iterative choice procedure for valuing the quality of inland waters, which breaks valuation into a series of component tasks. Respondents in Colorado and North Carolina assessed the value of water quality rated "good" by EPA standards, and it was found that the value of water increases with even a 1% increase in water quality. Study results noted differences in valuation of water quality for aquatic environment, edible fish, swimming, and for water that is cloudy, smelly, or polluted by toxins.

Postel, S. L. 1998. Allocating fresh water to aquatic ecosystems: The case of the Colorado River delta. *Water International* 23:119-125.

This is a case study of the potential economic benefits of a revitalized and protected delta ecosystem. The unique biological assets of the Colorado River delta estuary discussed in this paper indicate that efforts to determine and satisfy water needs of a threatened aquatic

environment are justified. Ways in which policy and legal reforms, economic incentives, and efficiency investments can help generate water supplies to rejuvenate and maintain a healthier delta ecosystem are discussed. Also discussed are priorities for delta restoration.

Van Den Bergh, J., P. Nunes, H. M. Dotinga, W. Kooistra, E. G. Vrieling and L. Peperzak. 2002. Exotic harmful algae in marine ecosystems: An integrated biological-economic-legal analysis of impacts and policies. *Marine Policy* 26:59-74.

Harmful algal blooms (HABs) are the cause of important damages to marine living resources and human beings. HABs are generated by micro-algae. These marine species are primarily introduced through ballast water of ships and, to a lesser extent, through import of living fish, in particular shellfish. Effective and efficient regulation of HABs requires an integration of insights from biological, economic and legal sciences. Such an integration consists of (a) a clear identification of the bio-ecological pathways and overall consequences related to the damages of HABs; (b) an assessment of monetary costs of HABs; and (c) an understanding of the set of complementary legal-institutional and economic instruments dealing with HABs through prevention, restoration and amelioration. This paper discusses each element in detail, in which biological, economic and legal aspects come together, drawing conclusions for decision making in marine management. In order to move away from the general level of discussion, an example of HABs is presented in which, biological, economic, and legal aspects are combined.

Whitehead, J. C. and P. A. Groothuis. 1992. Economic benefits of improved water quality: A case study of North Carolina's Tar-Pamlico River. *Rivers* 3:170-178.

A contingent valuation survey is used to measure the economic benefits of reduced agricultural non-point source pollution in the Tar-Pamlico River in eastern North Carolina. Surveys show respondents are willing to pay for improved water quality. Survey participants' age, number of children, income, and expected use are related to their willingness to pay. Regression results suggest that for open-ended willingness to pay response data, the Tobit technique is preferred to the ordinary least squares method due to additional information contained in the Tobit decomposition. Results imply that aggregate benefits of improved water quality would be $1.62 million each year, and the majority of voters would support a program that would raise up to $1.06 million annually for water quality improvements.

10. Miscellaneous Human Dimensions of Coastal Restoration Monitoring References

Bash, J. S. and C. M. Ryan. 2002. Stream restoration and enhancement projects: Is anyone monitoring? *Environmental Management* 29:877-885.

Declines in salmon stocks and general watershed health in Washington State, USA, have led to an increase in stream restoration and enhancement projects initiated throughout the state. The increasing number of projects has also raised questions regarding the monitoring of these efforts. Project managers receiving hydraulic project approvals (HPAs) were surveyed to determine whether monitoring was taking place on their projects. About half the project managers surveyed reported the collection of baseline data and the use of biological, physical, chemical, or other water quality measures for their projects. Of those who reported collection of monitoring data, only 18% indicated that monitoring was required. Respondents were also asked to rank the importance of various project goals on a Likert scale. Project managers with projects

focusing on "engineering" goals (e.g., roadbed stabilization) were less likely than other project managers to collect baseline monitoring data. Project managers with projects focusing on "restoration/ecological" or "fisheries" goals were more likely than other project managers to collect monitoring measures, Although monitoring appears to be taking place in slightly more than half of the projects surveyed, the nature of the data collected varies widely across projects, and in most cases the monitoring effort is voluntary. This suggests that project sponsors, funders, and managers must consider the issues involved in requiring appropriate monitoring, establishing standardized monitoring guidelines, the time frames in which to monitor, providing other incentives for conducting monitoring, and ensuring adequate funding for monitoring efforts.

Cowell. C. M. 1993. Ecological restoration and environmental ethics. *Environmental Ethics* 15:19-32.

Restoration ecology has recently emerged as a branch of scientific ecology that challenges many of the traditional tenets of environmentalism. Because the restoration of ecosystems, 'applied ecology,' has the potential to advance theoretical understanding to such an extent that scientists can extensively manipulate the environment, it encourages increasingly active human participation within ecosystems and could inhibit the preservation of areas from human influences. Despite the environmentally dangerous possibilities that this form of science and technology present, restoration offers an attractive alternative for human interaction with the environment. I outline the primary claims that have been made for ecological restoration, examine inconsistencies with restorationists' philosophical position, and propose a reassessment of the definition of restoration that may aid in the clarification and development of a system of environmental ethics that recognizes human relationships with the environment as potentially symbiotic and positive.

Light, A. and E. S. Higgs. 1996. The politics of ecological restoration. *Environmental Ethics* 18:227-247.

Discussion of ecological restoration in environmental ethics has tended to center on issues about the nature and character of the values that may or may not be produced by restored landscapes. In this paper we shift the philosophical discussion to another set of issues: the social and political context in which restorations are performed. We offer first an evaluation of the political issues in the practice of restoration in general and second an assessment of the political context into which restoration is moving. The former focuses on the inherent participatory capacity at the heart of restoration; the latter is concerned with the commodified use (primarily in the United States) and nationalized use (primarily in Canada) to which restoration is being put. By means of a comparative examination of these two areas of inquiry, we provide a foundation for a critical assessment of the politics of restoration based on the politics in restoration.

APPENDIX III: GLOSSARY OF HUMAN DIMENSIONS TERMS

Adaptive Management - A systematic process for continually improving management policies and practices by learning from the outcomes of operational programs. Its most effective form—"active" adaptive management—employs management programs that are designed to experimentally compare selected policies or practices, by evaluating alternative hypotheses about the system being managed.

Assigned Values - The relative importance or worth of something, usually in economic terms. Natural resource examples include the value of water for irrigation or hydropower, land for development, or forests for timber supply (see held values).

Asset Mapping - A community assessment research method that provides a graphical representation of a community's capacities and assets.

Attitude - An individual's consistent tendency to respond favorably or unfavorably toward a given attitude object. Attitudes can be canvassed through survey research and are often defined utilizing scales ranging from positive to negative evaluations.

Benefit-Cost Analysis - A comparison of economic benefits and costs to society of a policy, program, or action.

Bequest Value - The value that people place on knowing that future generations will have the option to enjoy something.

Causality - Or causation, refers to the relationship between causes and effects - i.e., to what extent does event 'A' (the cause) bring about effect 'B.'

Clustering (Cluster Sample) - A multistage sample in which natural groups (i.e., clusters) are sampled initially, with the members of each selected group being subsampled afterward.

Cognitive Mapping - A community assessment research method used to collect qualitative data and gain insight into how community members perceive their community and surrounding natural environment.

Cohort Studies - Longitudinal research aimed at studying changes in a particular subpopulation or cohort (e.g., age group) over time (see longitudinal studies).

Community - A group of people who interact socially, have common historical or other ties, meet each other's needs, share similar values, and often share physical space; a sense of "place" shaped by either natural boundaries (e.g., watershed), political or administrative boundaries (e.g., city, neighborhood), or physical infrastructure.

Computer-Assisted Telephone Interviewing (CATI) - A system for conducting telephone survey interviews that allows interviewers to enter data directly into a computer database. Some CATI systems also generate phone numbers and dial them automatically.

Concept Mapping - Community assessment research method that collects data about how community members perceive the causes or related factors of particular issues, topics, and problems.

Content Validity - In social science research content validity refers to the extent to which a measurement (i.e., parameter) reflects the specific intended domain of content (i.e., stated

goal or objective). That is, how well does the parameter measure whether or not a particular project goal has been met.

Contingent Choice Method - Estimates economic values for an ecosystem or environmental service. Based on the individual's tradeoffs among sets of ecosystems, environmental services or characteristics. Does not directly ask for willingness to pay; inferred from tradeoffs that include cost as an attribute.

Contingent Valuation Method (CVM) - Used when trying to determine the monetary valuation of a resource. The CVM can be used to determine changes in resource value as related to an increase or decrease in resource quantity or quality. Used to measure non-use attributes such as existence and bequest values; market data is not used.

Coverage Error - A type of survey error that can occur when the list – or frame – from which a sample is drawn does not include all elements of the population that researchers wish to study.

Cross-sectional Studies - Studies that investigate some phenomenon by taking a cross section (i.e., snapshot) of it at one time and analyzing that cross section carefully (see Longitudinal Studies).

Crowding - In outdoor recreation, crowding is a form of conflict (see outdoor recreation conflict) that is based on an individual's judgment of what is appropriate in a particular recreation activity and setting. Use level is not interpreted negatively as crowding until it is perceived to interfere with one's objectives or values. Besides use level, factors that can influence perceptions of crowding include participant's motivations, expectations, and experience related to the activity, and characteristics of those encountered such as group size, behavior, and mode of travel.

Culture - A system of learned behaviors, values, ideologies, and social arrangements. These features, in addition to tools and expressive elements such as graphic arts, help humans interpret their universe as well as deal with features of their environments, both natural and social.

Direct Impacts - The changes in economic activity during the first round of spending. For tourism this involves the impacts on the tourism industries (businesses selling directly to tourists) themselves (see Secondary Effects).

Direct Use Values - Refers to the set of values derived from any direct use of natural environments.

Driving Forces - The base drivers that play a large role in people's decision making processes and influence human behavior. Societal forces such as population, economy, technology, ideology, politics and social organizations are all drivers of environmental change.

Economic Impact Analysis - Used to estimate how changes in the flow of goods and services can affect an economy. Measure of the impact of dollars from outside a defined region/area on that region's economy. This method is often used in estimating the value of resource conservation.

Ecosystem Services - The full range of goods and services provided by natural ecological systems that cumulatively function as fundamental life-support for the planet. The life-support functions performed by ecosystem services can be divided into two groups - production functions (i.e., goods) and processing and regulation functions (i.e., services).

Environmental Equity - The perceived fairness in the distribution of environmental quality across groups of people with different characteristics.

Environmental Justice - A social movement focused on the perceived fairness in the distribution of environmental quality among people of different ethnic or socio-economic groups.

Existence Value - The value that people place on simply knowing that something exists, even if they will never see it or use it.

Fishery Dependent Data - Data on fish biology, ecology, and population dynamics that is collected in connection with commercial, recreational, or subsistence fisheries.

Focus Group - A small group of people (usually 8 to 12) that are brought together by a moderator to discuss their opinions on a list of predetermined issues. Focus groups are designed to collect very detailed information on a limited number of topics.

Hedonic Pricing Method - Estimates economic values for ecosystem or environmental services that directly affect market prices of some other good. Most commonly applied to variations in housing prices that reflect the value of local environmental attributes.

Held Values - Conceptual precepts and ideals held by an individual about something. Natural resource examples include the symbolic value of a bald eagle or the aesthetic value of enjoying a beautiful sunset (see assigned values).

Human Dimensions - A multidisciplinary/ interdisciplinary area of investigation which attempts to describe, predict, understand, and affect human thought and action toward natural environments in an effort to improve natural resource and environmental stewardship. Disciplines within which human dimensions research is conducted include (but are not limited to) sociology, psychology, resource economics, geography, anthropology, and political science.

Human Dominant Values - This end of the natural resource value continuum emphasizes the use of natural resources to meet basic human needs. These are often described as utilitarian, materialistic, consumptive, or economic in nature.

Human Mutual Values - The polar opposite of human dominant values, this end of the natural resource value continuum emphasizes spiritual, aesthetic, and nonconsumptive values in nature.

IMPLAN - A micro-computer-based input output modeling system(see Input-output model below). With IMPLAN, one can estimate 528 sector I-O models for any region consisting of one or more counties. IMPLAN includes procedures for generating multipliers and estimating impacts by applying final demand changes to the model.

Indirect Impacts - The changes in sales, income, or employment within a region in backward-linked industries supplying goods and services to tourism businesses. For example, the increased sales in linen supply firms resulting from more motel sales is an indirect effect of visitor spending.

Induced Impacts - The increased sales within a region from household spending of the income earned in tourism and supporting industries. Employees in tourism and supporting industries spend the income they earn from tourism on housing, utilities, groceries, and other consumer goods and services. This generates sales, income, and employment throughout the region's economy.

Informed consent - An ethical guideline for conducting social science research. Informed consent emphasizes the importance of both accurately informing research participants as to the nature of the research and obtaining their verbal or written consent to participate.

The purpose, procedures, data collection methods and potential risks (both physical and psychological) should be clearly explained to participants without any deception.

Input-Output Model (I-O) - An input-output model is a representation of the flows of economic activity between sectors within a region. The model captures what each business or sector must purchase from every other sector in order to produce a dollar's worth of goods or services. Using such a model, flows of economic activity associated with any change in spending may be traced either forwards (spending generating income which induces further spending) or backwards (visitor purchases of meals leads restaurants to purchase additional inputs -- groceries, utilities, etc.). Multipliers may be derived from input-output models (see multipliers).

Instrumental Values - The usefulness of something as a means to some desirable human end. Natural resource examples include economic and life support values associated with natural products and ecosystem functions (see non-instrumental values).

Intergenerational Equity - The perceived fairness in the distribution of project costs and benefits across different generations, including future generations not born yet.

Intrinsic Values - Values not assigned by humans but are inherent in the object or its relationship to other objects.

Large-scale Commercial Fishing - Fishing fleets that are owned by corporations with large capital investments, and are highly mobile in their global pursuit of fish populations.

Longitudinal Studies - Social science research designed to permit observations over an extended period of time (see trend studies, cohort studies, and panel studies).

Market Price Method - Estimates economic values for ecosystem products or services that are bought and sold in commercial markets.

Measurement Error - A type of survey error that occurs when a respondent's answer to a given question is inaccurate, imprecise, or cannot be compared to other respondent's answers.

Multipliers - Capture the size of the secondary effects in a given region, generally as a ratio of the total change in economic activity in the region relative to the direct change. Multipliers may be expressed as ratios of sales, income or employment, or as ratios of total income or employment changes relative to direct sales. Multipliers express the degree of interdependency between sectors in a region's economy and therefore vary considerably across regions and sectors.

Non-instrumental Values - Something that is valued for what it is; a good of its own; an end in itself. Natural resource examples include aesthetic and spiritual values found in nature (see instrumental values).

Non-market Goods and Services - Goods and services for which no traditional market exists whereby suppliers and consumers come together and agree on a price. Many ecosystem services and environmental values fall under this category.

Nonresponse Error - A type of survey error that occurs when a significant proportion of the survey sample do not respond to the questionnaire and are different from those who do in a way that is important to the study.

Non-use Values - Also called "passive use" values, these are values that are not associated with current use (see bequest, existence, and option values).

Norms - Perceived standards of acceptable attitudes and behaviors held by a society (social norms) or by an individual (personal norms). Serve as guideposts for what is appropriate behavior in a specific situation.

Opportunity Cost - The cost incurred when an economic decision is made. This cost is equal to the benefit of the most highly valued alternative that would have been gained if a different decision had been made. For example, if a consumer has $2.00 and decides to purchase a sandwich, the economic cost may be that consumer can no longer use that money to buy fruit.

Option Value - The value associated with having the option or opportunity to benefit from some resource in the future.

Outdoor Recreation Conflict - Defined as behavior of an individual or group that is incompatible with the social, psychological or physical goals of another person or group.

Panel Studies - Longitudinal research that studies the same set of people through time in order to investigate changes in individuals over time (see Longitudinal Studies).

Population List - In social science survey research, this is the list from which the sample is drawn. This list should be as complete and accurate as possible and should closely reflect your target population.

Precision - A statistical term that refers to the reproducibility of the result or measurement. Precision is measured by uncertainty and is usually expressed as the standard error or some confidence interval around the estimated mean.

Random Utility Models - A non-market valuation technique that focuses on the choices or preferences of recreationists among alternative recreational sites. Particularly appropriate when substitutes are available to the individual so that the economist is measuring the value of the quality characteristics of one or more site alternatives (e.g., a fully restored coastal wetland and a degraded coastal wetland).

Reliability - The likelihood that a given measurement procedure or technique will yield the same result each time that measure is repeated (i.e., reproducibility of the result).

RVD (recreational visitor day) - One RVD is defined as 12 hours of use in some recreational activity. This could be one person using an area for 12 hours, or 2 people using an area for 6 hours each, or any combination of people and time adding to 12 hours of use.

Sample - In social science survey research, this is a set of respondents selected from a larger population for the purpose of a survey.

Sampling Error - A potential source of survey error that can occur when researchers survey only a subset or sample of all people in the population instead of conducting a census. To minimize this error the sample should be as representative of the population as possible.

Satisfaction - In outdoor recreation, satisfaction is defined as the difference between desired and achieved goals. Can be measured through surveys of recreation participants.

Secondary Data - Information that has already been assembled, having been collected for some other purpose. Sources include census reports, state and federal agency data, and university research.

Secondary Effects - The changes in economic activity from subsequent rounds of re-spending of tourism dollars. There are two types of secondary effects - indirect effects and induced effects.

Sector - A grouping of industries that produce similar products or services. Most economic reporting and models in the U.S. are based on the Standard Industrial Classification system (SIC code). Tourism is more an activity or type of customer than an industrial sector. While hotels (SIC 70) are a relatively pure tourism sector, restaurants, retail establishments and amusements sell to both tourists and local customers. There is therefore no simple way to identify tourism sales in the existing economic reporting systems, which is why visitor surveys are required to estimate tourist spending.

Simple Random Sampling (SRS) - In survey research, when each member of the target population has an equal chance of being selected. If a population list exists, SRS can be achieved using computer-generated random numbers.

Small-scale Commercial Fishing - Fishing operations that have relatively small capital investment and levels of production, and are more limited in terms of mobility and resource options (compared to large-scale operations). Terms that are commonly used to describe small-scale fishermen include artisanal, native, coastal, inshore, tribal, peasant, and traditional.

Social Capital - Describes the internal social and cultural coherence of society, the norms and values that govern interactions among people and the institutions in which they are embedded.

Social Impact Assessment (SIA) - Analysis conducted to assess, in advance, the social consequences that are likely to follow from specific policy actions and alternatives. Social impacts in this context refer to the consequences to human populations that alter the ways in which people live, work, play, relate to one another, organize, and generally cope as members of society.

Social Network Mapping - Community assessment research method used to collect, analyze, and graphically represent data that describe patterns of communication and relationships within a community.

Stakeholders - Individuals, groups, or sectors that have a direct interest in and/or are impacted by the use and management of natural resources in a particular area, or that have responsibility for management of those resources.

Stratification - The grouping of the units composing a population into homogeneous groups (or strata) before sampling. This procedure, which may be used in conjunction with simple random, systematic, or cluster sampling, improves the representativeness of a sample, at least in terms of the stratification variables.

Subsistence - Describes the customary and traditional uses of renewable resources (i.e., food, shelter, clothing, fuel) for direct personal/ family consumption, sharing with other community members, or for barter. Subsistence communities are often held together by patterns of natural resource production, distribution, exchange, and consumption which helps maintain a complex web of social relations involving authority, respect, wealth, obligation, status, power and security.

Systematic Sampling - A type of probability sample in which every k^{th} unit in a list is selected for inclusion in the sample - for example, every 10^{th} fisherman on a list of licensed fishermen. The sampling interval, k, is computed by dividing the size of the population by the desired sample size.

Target Population - The subset of people who are the focus of a survey research project.

Travel Cost Method (TCM) - TCM is used to estimate monetary value of a geographical site in its current condition (i.e., environmental health, recreational use capacity, etc.) by site-users. Individuals or groups report travel-related expenditures made while on trips to single and multiple recreational sites. Market values are used.

Trend Studies - Longitudinal research that studies changes within some general population over time (see longitudinal studies).

Utilitarian Value - Valuing some object for its usefulness in meeting certain basic human needs (e.g., food, shelter, clothing). Also see human-dominant values.

Validity - Refers to how close to a true or accepted value a measurement lies.

Weighting - A procedure used in connection with sampling whereby units selected with unequal probabilities are assigned weights in such a manner as to make the sample representative of the population from which it was selected.

Willingness-To-Pay - The amount in goods, services, or dollars that a person is willing to give up to get a particular good or service.

APPENDIX IV: LIST OF HUMAN DIMENSIONS EXPERTS

The experts listed below have provided their contact information so practitioners may contact them with questions pertaining to the human dimensions of restoration monitoring. Contact information is up-to-date as of the printing of this volume. The list below includes only those experts who were: 1) contacted by the authors and 2) agreed to submit their contact information. Some of those listed also reviewed the associated chapter. In addition to these resources, practitioners are encouraged to seek the advice of local human dimensions experts as well as faculty members and researchers at colleges and universities. These people are often extremely knowledgeable in local habitats and their relationship to local communities. They also often have experience in implementing monitoring projects as well as designing and conducting surveys and other data collection techniques. Finally local, state, and Federal environmental agencies also house many experts who monitor and manage coastal habitats and related human dimensions. In addition to the National Oceanic and Atmospheric Administration (NOAA), the Environmental Protection Agency (EPA), the Army Corps of Engineers (ACE), Fish and Wildlife Service (FWS), and the United States Geologic Survey (USGS) are important Federal agencies to contact for assistance in designing restoration and monitoring projects as well as potential sources of funding and permits to conduct work in coastal waterways.

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