

**SEASCAPES: Getting to Know the Sea Around Us**

*A Guide to Characterizing Marine and Coastal Areas*

**Section 2:  
A Course of Action for Marine  
Area Characterization**



QUEBEC-LABRADOR FOUNDATION  
Atlantic Center for the Environment

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# Section 2 A Course of Action for Marine Area Characterization

## Overview

Every marine area characterization is different. Each has a unique combination of goals, funding, interests, skills, information sources, and geographic focus. Because of the endless variety, it is impossible to prescribe a process for how to do a marine area characterization. However, this section describes common steps that may be included in the course of action for planning and conducting a marine area characterization. Following these recommendations can help to ensure that the characterization is successful.

## Planning

### Step 1: Identify the Reasons for Doing the Characterization

Why is the characterization being conducted? What are the goals, and what are the desired outcomes? Is there a particular management issue or human impact that requires attention in the area? Is the project aimed broadly at strengthening community ties and improving the overall understanding of the area, rather than solving a particular environmental problem?

A clear, shared understanding among the project participants is needed to ensure that goals are achieved successfully and efficiently.

A marine area characterization project needs clear goals that are put into writing. Decide the goals early in the project and use them as a touchstone for maintaining focus throughout each stage. Over time, the project might expand beyond the original purpose because of unforeseen needs, questions, and opportunities, as was the case for characterization work in Penobscot Bay

(see page 17). But the written goals serve as a guide for all subsequent steps—from engaging other people to gathering information to sharing findings.

To begin developing the goals statement, pull project partners and advisors together to discuss their areas of interest, motivation, and intended outcomes for the marine area characterization. Why are you conducting a marine area characterization? What

needs will the project address? What questions is it intended to answer? What is the project's geographic scope? The answers to these questions provide fodder for the goals statement, which provides a framework for specific objectives and tasks.

The process of developing the goals statement is just as important as the statement itself. It can build support among people who might not otherwise feel part of the characterization effort. It can also prevent conflicts later in the characterization process by reducing misunderstandings of the project's goals.

The goals statement can facilitate prioritizing

of project tasks and budgets. After the characterization information has been gathered, the goals statement can be used to determine the best way to share the findings. Finally, a clearly written goals statement makes it possible to evaluate the success of the project after it is completed.

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**Outputs:** Concise written record of the project's goals. Map identifying project area.

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## Steps in Marine Area Characterization

### Planning

- Step 1: Identify the Reasons for Doing the Characterization
- Step 2: Involve Key People
- Step 3: Clarify Themes for the Project
- Step 4: Create a Strategy for Sharing the Findings

### Developing Tools and Acquiring Resources

- Step 5: Decide Types of Information to Gather
- Step 6: Set Up a System to Store Information
- Step 7: Consider Seeking Funds

### Conducting the Characterization

- Step 8: Find and Compile Existing Information
- Step 9: Conduct Original Research
  - Step 9a: Identify Gaps in Knowledge
  - Step 9b: Determine How to Fill Gaps
  - Step 9c: Marshal Resources
  - Step 9d: Conduct Research and Monitoring

### Producing and Sharing Findings

- Step 10: Analyze Data and Produce Findings
- Step 11: Review Findings
- Step 12: Share Findings

## Step 2: Involve Key People

A marine area characterization requires participants with a range of perspectives, skills, and knowledge to guide, manage, and carry out the project and to apply its results. Early in the process, it is vital to involve as many people and organizations as possible who have relevant skills or who may be affected by outcomes resulting from the characterization. When people are involved early, their knowledge and perspectives can guide the project, and they are likely to be more interested in its findings. For example, scientists and resource managers can provide valuable input on how to collect data that are scientifically defensible and useful in a management context. Fishermen and others knowledgeable about the local environment can provide important information about the area and

how it is used. Not everyone needs to become an active participant in the project, but seeking their advice, incorporating their knowledge, and making them aware of the project will build credibility and buy-in. Ultimately, the project's success and impact depend on the support it receives from people outside the project's core participants. In addition, early engagement with a range of people will help the project organizers to clarify the project's scope and goals and to evaluate the requirements for personnel and funding.

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**Outputs:** List of participants, advisors, and consultants. List of participants' areas of expertise. List of other expertise needed. A name for the group conducting the characterization or for the project.

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### What Area Are We Characterizing?

Some marine area characterizations focus on a town's harbor, while others cover thousands of square miles of ocean. Whatever the geographic scale, it is important to define exactly what area is being characterized, so the project keeps its focus. If the area is along the coast, how far offshore will be characterized? Will the characterization go inland into the watershed or stop at the high-tide line? For example, if the project is a local community activity for a town, then the town's borders might serve by default as the project's boundaries. However, if the goal is to provide information for ecosystem-based management, then it is usually advantageous to choose natural boundaries such as watersheds, bays, and/or the edge of the coastal shelf, rather than political boundaries.

Choosing boundaries is by necessity an arbitrary process. Once a boundary is chosen, those factors that do not conform to the boundaries ought to be noted. For example, ocean currents probably go across the boundaries. Fish are likely to move into and out of the study area. Perhaps the area is important for shorebirds, but only as a stop along their migration. Essentially, any study area is nested within a hierarchy of larger, smaller, and overlapping areas. Recognizing these connections is important for understanding the study area.

#### Examples of Possible Boundaries

**Natural boundaries.** Coastal features (harbors, coves, bays, gulfs, sounds, estuaries, islands, capes, headlands, and peninsulas); watersheds; oceanographic features such as currents (e.g., Eastern Maine Coastal Current, Gulf Stream); seafloor features (banks, channels, basins, ledges, shoals, reefs, continental shelf or slope); rivers and river mouths; salinity or tidal gradients; geographic range limits of animal and plant species; edges of biogeographic regions.

**Political boundaries.** Town, county, state, provincial, and national borders; resource management areas (e.g., lobster zones, urchin harvesting zones); jurisdictions, such as state or federal waters; areas of influence for relevant government agencies (e.g., marine resource management, environmental protection).

**Cultural, organizational, or use-related boundaries.** Areas used for particular industries (e.g., shipping, dredging, aquaculture, energy, communications); area of concern for the organization conducting the characterization; area defined by previous scientific studies or conservation efforts; areas of historic use such as shipbuilding, canneries, farming.

**Other boundaries.** Latitude/longitude; specific depth or distance offshore/inland; limits imposed by sampling devices or technology used for characterization, such as mooring arrays or high-frequency radar.

## Who Might Participate?

- **Volunteers and community groups.** Dedicated volunteers can be invaluable participants and leaders. Residents may contribute valuable time and local knowledge to the project, and some volunteers may bring skills, such as database design, birding, and boat operation. Volunteers may be able to do substantial parts of the work involved in a marine area characterization, given adequate training and guidance or their existing career skills. For example, skilled recreational boaters with GPS and depth sounders could be organized to map the underwater topography of a bay. Coastal landowners could set up and maintain basic meteorological stations to collect data on wind and other parameters. Sometimes volunteers even have specialized skills that would normally require hiring consultants.
- **Scientists and/or their graduate students with relevant expertise.** Scientists are essential to engage in any marine area characterization. They may come from academic institutions, government agencies, industry, consulting firms, or non-government organizations. They may be based locally or elsewhere in the state, region, or country. They may include marine biologists, ecologists, oceanographers (biological, physical, chemical, geological), zoologists, botanists, geologists, environmental chemists, geographers, and hydrologists. They may have conducted previous studies in the geographic area of interest or similar studies elsewhere. Scientists may provide guidance to volunteers and assist with data analysis and synthesis.
- **Resource users who know the area through frequent use and observation.** Commercial and recreational fishermen, aquaculturists, hunters, farmers, boaters, mariners, land surveyors, loggers, naturalists, birders, divers, and others may live locally or commute to the area for their work. Years of direct contact with the area and its resources give these people an invaluable breadth and depth of knowledge about the area.
- **Municipal officials.** The local mayor, port authority, planning board, conservation commission, code enforcement officer, shellfish warden, harbor master, and other officials may contribute information and ultimately use the characterization's findings.
- **Staff members from government agencies.** State agencies (e.g., coastal zone management program, marine resources, fish and wildlife, environmental protection, state planning office) and federal agencies (e.g., National Oceanic and Atmospheric Administration, U.S. Fish and Wildlife Service, Environmental Protection Agency, U.S. Geological Survey) have resource managers, scientists, planners, GIS specialists, enforcement officers, policy specialists, and educators.
- **Business people and commercial interests.** Tourist-oriented companies, aquatic businesses, professional associations, and industrial and trade associations may participate by providing information, funding, and perspectives on how to make a marine area characterization useful.
- **Staff members and volunteers from non-government organizations.** Cultural (ethnic, art, music), educational, and outdoors (birding, kayaking, boating) organizations, as well as land trusts, conservation groups, and historical societies may be interested in participating in the characterization process and using the results.
- **Writers, editors, graphic designers, illustrators, photographers, mapping (GIS) technicians, and Web designers.** People with these skills can help identify needs for particular types of information, plan how to address those needs, and develop compelling ways to communicate findings of a marine area characterization.



### Step 3: Clarify Themes for the Project

The information collected during a marine area characterization needs to be organized and communicated effectively. Without well-defined themes, the information collected during the characterization could remain difficult to use and therefore underutilized. From the beginning of the project, identify the project's focal themes.

Themes are related to project goals, but they serve a more narrow function. Project goals are the grand targets that the organizers ultimately want to accomplish. Project themes provide a framework for collecting, organizing, and communicating data and information throughout the characterization process,

and help the characterization project to generate a targeted body of information. Project themes might relate to habitats and species in the area; historical and recent changes in environmental quality and human activity in the area; economic resources and value of the area; and current health of the ecosystem.

Of course, the findings will be unknown until after the information is collected and analyzed during the characterization process. However, project participants can decide on the project themes. The themes may or may not be explicitly stated in the project's end products, but they should be identified clearly in the early planning stages of the characterization.

## Variations on a Theme

### A marine area characterization might:

- explore interconnections between land and sea *or* focus on the sea.
- delve into economics of commercial activities *or* orient toward non-economic information.
- focus on contaminants and water quality *or* seek to understand the effects of fishing, study a few types of animals, *or* look holistically at habitats and the entire ecosystem.

These themes guide the people responsible for gathering existing information. They are crucial for planning and creating end products, such as booklets, Web pages, and maps.

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**Output:** Description of project themes.

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### **Step 4: Create a Strategy for Sharing the Findings**

Generally, the overarching goals of a marine area characterization are to (1) gather and integrate information about a marine area, (2) communicate the information, and (3) use the information to guide resource management decisions.

At first, it might seem advantageous to approach these goals sequentially—first compiling the information and then focusing on disseminating and using it—but the goals are highly interdependent and are best pursued together. For example, creating a strategy for sharing the findings early in the project helps to define what information resources are needed. Then the project team knows in advance the planned communication products of the characterization and can obtain the information efficiently. In addition, it is usually valuable to communicate with the intended audience during the project, instead of only at the end, by producing fact sheets, press releases, and presentations about upcoming or recent activities.

Who will use the information? Whom do you wish to reach? Examples of potential audiences and users include state and federal resource managers, policy makers, conservation commissions, planners, municipal officials, academic scientists, fishermen, community groups, journalists, non-government organizations, interested local citizens, students and teachers, and marine-oriented business people. Each of these audiences has different information needs. They may want different types of information from a marine area characterization or some may respond better to a particular mode of delivery than others.

Identifying the intended audience is essential because it enables the project organizers to decide what information should be included in the characterization, how information should be organized and portrayed, and which stakeholders should be involved. For example, a characterization project could generate one set of products for resource managers and another set for students and teachers.

The goals, themes, and target audiences for the project are the key considerations when deciding how you will communicate the information that you find. These factors determine the amount, complexity, subject matter, and format of information that needs to be collected. The communications strategy identifies the products that will come out of the characterization and how they will be developed. It also determines ways to build support for the project and interest in its results. For example, people conducting a marine area characterization might decide to share the information through an eye-catching, colorful booklet for a general audience, online maps for coastal landowners, workshops for resource managers and municipal officials, a technical report for scientists, or public displays for children.

The strategy for sharing information is critical. It makes the difference between a marine area characterization that reaches, engages, and is used by the target audience versus one that sits on the shelf. The strategy requires careful thought during the early planning phase of a marine characterization. Products from other marine area characterizations (see examples on pages 14, 16, 17) can provide ideas and inspiration.

Consider hiring independent contractors who specialize in marine science communications to non-scientific audiences. If they are engaged early in the project, such experts can facilitate the process to ensure that the marine area characterization accomplishes its goals. They can help create the communications strategy, envision the end products, and eventually produce them.

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**Outputs:** Description of target audience. Strategy for sharing findings.

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## Developing tools and acquiring resources

### Step 5: Decide the Types of Information to Gather

Section 3 of this guide discusses the types of information developed and recommended by a group of specialists as the elements of a comprehensive marine area characterization. A characterization that includes all of the recommended information will provide a comprehensive description of a marine area. In reality, however, marine area characterizations typically are constrained by budget, time, and expertise, and they cannot include the full suite of information. The list of components in Section 3 can be reviewed and whittled down to those that are critical to the project's goals and can be accomplished with available resources. If more resources become available or the project's goals expand, then more components can be added later for a more complete characterization.

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**Output:** List of information components to be included in the project.

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### Step 6: Set Up a System to Store Information

Producing a marine area characterization can involve large amounts of data and information. The project may compile stacks of scientific articles, books, technical reports, historical documents, data sets, images, maps, and other resources. Some of them may be hard copies, while others are in electronic format. All of the information needs to be kept organized and accessible during and after the characterization process. For the characterization process to be efficient and effective, a system needs to be set up for storing data and information. The system may be as simple as a set of folders in a file cabinet or as sophisticated as a Web site with databases and interactive maps. Some important aspects of information storage include:

- Who stores the information? Is it a single person, a lead organization, or several organizations?
- How do participants gain access to the information? Is it loaned out? Are summaries sent to all participants?
- How are participants notified of additions to the information to prevent duplicative efforts?

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**Output:** System for organizing and storing data and information.

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### Step 7: Consider Seeking Funds

People and financial support are the major resources needed to carry out a marine area characterization. Funding is required not only to conduct research but to synthesize findings, produce reports and other communications products, and disseminate results. Determine which components of the characterization will be performed by volunteers, independent contractors, or staff, based on the skills and time required for the work. Funding may come in the form of grants or in-kind contributions from sources such as government agencies, foundations, and corporations. It might also be raised from individual donors or local businesses with a keen interest in the area, as well as through fundraising events. Many different funding sources exist, but tracking them down and acquiring funds can be a challenge. There are many strategies and important lessons to successful fundraising, which vary depending on the source of the income. Securing funding may absorb a large amount of time during the characterization process. Once funds are obtained, they must also be tracked, managed and, in some instances, reported on. However, after initial funding is obtained, it often becomes easier to find and obtain additional funding. Having well-defined goals, themes, and target audiences will help greatly in building support and momentum for the project, as will an effective strategy for communicating the project's goals, expected impacts, and likely products. Financial support early in the characterization process could allow the group to hire people with necessary expertise and to provide training for volunteers.

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**Output:** Funding for the project.

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## Conducting the characterization

### Step 8: Find and Compile Existing Information

There is tremendous value in finding and integrating information that already exists about a marine area's biology, ecology, oceanography, human activities, and socioeconomics. For some marine areas, considerable information is available, but typically it is scattered among many books, articles, historical documents, maps, Web sites, and people's memories. It usually has not been gathered and made available in a useful,

compelling way to tell a complete story about the place. Some marine area characterizations involve original scientific research or monitoring.

Finding existing information might involve a combination of Web searches, library research, telephone calls, and in-person discussions. There are many places to look for existing information. The search is also a very effective way to involve people in the project and to increase people's interest in it. Some sources of information are obvious and easy to access, while others are obscure and require a bit of digging. Appendix A provides details on where to find key types of information.

The search should focus on the types of information identified in Step 5 as priorities. But it is worth staying alert for easy opportunities to get other information without much additional effort. Maps, photographs, charts, and graphs—along with written documents and data sets—are all fair game and ought to be gathered.

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**Output:** Annotated bibliography and collection of information resources, including lists of organizations and individuals knowledgeable about the area.

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### **Step 9: Conduct Original Research (optional)**

Some marine area characterizations include original research. The need to develop new information depends largely on the project's goals, the group's capacity, and the kinds of information gaps that need filling. Steps 9a–9d provide an overview of the process, if you are thinking about conducting original research or hiring someone to do it.

#### **Step 9a: Identify Gaps in Knowledge**

Use the information uncovered in Step 8 to figure out what is not known about your area. What vital questions have not yet been answered? Which information components cannot be addressed with existing information? What necessary research, monitoring, analysis, or synthesis has not occurred in your area? Consider why such research and synthesis has not been undertaken before. Is it simply because of lack of previous funding or interest, or are there logistical or technical challenges that you should take into account for your own work?

### **A Few Ways to Find What You Need**

- Conduct a literature search to uncover articles and books about the marine area. Obtain the sources on the Web; through interlibrary loan; at major libraries; and in special collections of museums, research stations, town halls, and historical societies.
- Contact government agencies and non-government organizations for relevant data that they have collected.
- Interview local people who have knowledge of the area

### **Step 9b: Plan Research to Fill Gaps**

Research to collect new information about an area can take many forms. Many people think first of scientific experiments. But collecting new and previously unavailable information can also involve monitoring programs, weather or temperature readings, mapping efforts, conducting surveys, and interviewing people. Some of these methods might be done by the characterization team. Others might require the services of professional, outside researchers. Consider what information you wish to collect and what skills and level of expertise will be needed. When working with outside professionals or institutions, also determine who owns the data developed for the project and how it will be used or shared. Then clarify this mutual understanding through a written agreement before the research begins.

Section 3 of this guide describes the types of information that are needed for a complete characterization and some ways of obtaining the information. More than one method may be available for collecting a particular type of data. The methods may range widely in their expense, accuracy, ease of use, value for scientific analysis, and comparability of results with other studies. For example, trained volunteers can provide good data using a simple tool called a Secchi disk to measure water clarity, while professional researchers might use sophisticated instruments to provide more exact information. Another consideration is the frequency of data collection, which might occur monthly at a single location or daily at a dozen locations. Generally QA/QC data, or data that are quality assured and controlled, will have more value beyond the project's purposes than less rigorous data.

Depending on the purpose of the research, however, an inexpensive and easy option might be perfectly acceptable, or there might be important reasons to use a more costly, complicated method. The benefits of the different options should be weighed to determine which fits best with the purpose, funding, and expertise available for the project. Choose the research methods in consultation with scientific experts, because faulty decisions about the research plan could later

undermine the scientific validity of the findings, reducing their value for resource management and other purposes. Integrating the characterization with existing research efforts by government agencies or university scientists can help to reduce the costs to the characterization project itself.

After the research methodologies are chosen, a detailed research plan must be developed. The research plan outlines when, where, and how sampling will be conducted. Some types of information might only be collected once, such as water-depth soundings for mapping bathymetry (seafloor topography). Other variables must be measured repeatedly in order to characterize them accurately, such as water temperature throughout a year or bird abundance before, during, and after migration. Likewise, some types of data may need to be collected only at one site, whereas other types may need to be measured at many sites. The research plan makes it possible to estimate the necessary personnel, equipment, supplies, and funding.

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**Output:** Research plan that describes any methods that will be used for assuring and controlling data quality.

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### **Step 9c: Marshal Research Resources**

Some research and monitoring methods are practical for citizen groups and volunteers to perform. For example, many volunteer groups conduct water-quality monitoring, and these programs or similar volunteer-based efforts might be incorporated into a marine area characterization. Likewise, many amateur birders are skilled at observing and identifying coastal bird species, and they could play a valuable role as volunteers in a marine area characterization. Recreational boaters and commercial fishermen often have the equipment—depth sounders and GPS units—needed to map the contours of the seabed, with guidance from scientists. Measurements of wind and temperature are another type of data collection that volunteers can perform successfully with advice from scientific experts.

One important challenge is to develop ways to attract volunteers and to involve them in meaningful tasks that meet data needs while fulfilling their expectations. Volunteers also can be integral outside the data collection phase—to enter data into a database,

for example. Methods to assess and control the quality of the data are important. Sometimes retired scientists or other highly skilled people can be recruited as volunteers to oversee the training and quality control.

Just as important, recognize which aspects of the project require a greater level of expertise than what is available from project participants. Consider hiring or developing partnerships with consultants, academic scientists, and government agencies to conduct volunteer training, data quality control, and fieldwork.

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**Output:** Trained volunteers and other partners or contractors to conduct research.

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### **Step 9d: Conduct Research and Monitoring**

The research plan (Step 9b) describes the research and monitoring activities that will be conducted and when they will occur. Experts should help guide the planning and implementation of data collection to ensure that the data are scientifically defensible.

For example, an expert might notice odd patterns in the data or see values far outside the expected range, indicating a potential problem with data collection. It is prudent to check the data being gathered early in the project to identify any problems in the method and/or documentation and then correct them. If you wait until the end of the data-gathering phase of the project, you may find that you cannot use some of the data due to incorrect methods or poor recordkeeping.

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**Output:** Data

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Natalie Springuel



Keri Lindberg

## Producing and sharing findings

### Step 10: Analyze Data and Produce Findings

The overall goal of data analysis is to uncover the story contained in the data and other pieces of raw or primary information. What do the data reveal, confirm, or call into question? New data should be considered in light of what was previously known—and unknown—about the area. What stories can be told using the data? What new questions does the new information raise?

Individual pieces of data often mean little. They typically need to be organized into larger groups and analyzed to identify meaningful trends and patterns. Analytical techniques can vary greatly depending upon the subject matter. Statistical analysis is a common tool for natural scientists. For example, if two water samples are measured at two places in a bay, one place might have a higher concentration of pollutants, seemingly showing that it is more polluted than the other place. But if multiple samples were taken at both places, statistical analysis might demonstrate that no true difference exists—the initial difference arose due to chance and does not represent an actual difference between the two areas. Conversely, such an analysis might show conclusively that a real difference does exist.

Statistical analysis can reveal patterns that may not be apparent just by looking at raw data. For example, raw data on the abundance of plants in two neighboring salt marshes might look like a hodgepodge of numbers, but statistical analysis might reveal meaningful patterns in where the plants live, such as an increase in brackish-water plants in one salt marsh.

For a marine area characterization, a useful method for synthesizing a wide range of data is to produce maps with geographic information systems (GIS). GIS enables different types of data to be plotted on maps of the area (see page 29). Displaying data on maps often reveals patterns and suggests relationships. GIS software also has the capability to do analysis, as well as visualization of data. Skilled technicians, such as GIS experts, may be essential for data synthesis during a marine area characterization.

For the most part, data analysis and synthesis should be done by professional scientists who are trained in the intricacies of statistics.

**Outputs:** Data summaries, maps, and other illustrations that describe findings.

### Step 11: Evaluate Findings

After data analysis and synthesis are complete, contact outside experts who were not involved in the project to review the results and make sure the findings are scientifically sound. The reviewers must have relevant expertise and be able to provide impartial criticism of the scientific methods and findings. Although careful planning and evaluation of the characterization methods and data should have occurred throughout the characterization process, this final review is essential to catch any previously unrecognized shortcomings in the research methods or errors in interpretation of the results. This practice, called peer review, is a standard procedure in scientific research to help ensure that the conclusions drawn from a study are accurate. Peer review can also help to identify new or lingering questions that could be answered through additional research.

**Output:** Recommendations for strengthening the study. Suggestions for further research.

### Step 12: Share Findings

Step 4 focused on developing a strategy for sharing findings. After the research has been done and the data analyzed, it is time to implement the strategy. Publications, Web pages, and other products are likely to be important elements of implementing the strategy.

These products tell the story of the marine area as revealed through the information gathering, data collection, and analysis. If the characterization project included all—or even most—of the types of information discussed in Section 3, the result could be a very thorough examination of the marine area based on scientifically sound research.

Focus the communications products on the project themes identified in Step 3. Develop clear messages to convey findings in a way that relates them to the

to convey findings in a way that relates them to the themes. Producing effective communications products is just as critical—and challenging—as the earlier steps in the characterization process. Without effective communications products, the value of a marine area characterization is greatly diminished.

Frequently people dedicate considerable time to creating documents but give scant attention to distributing them. In the communications strategy for a marine area characterization, clearly identify how the products will be distributed. Compile postal and e-mail lists for the target audience and identify other opportunities for distributing the products, such as

newspaper inserts and press releases. Findings can be shared through public talks, presentations at workshops and conferences, personal meetings with coastal decision-makers, scientific journal articles, and public displays. When implementing the communications strategy, accommodate unanticipated opportunities, changes in funding, and unexpected findings that might be useful to other audiences.

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**Outputs:** Booklets, reports, Web sites, and other products that share findings with target audience. Distribution lists and methods.

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### Tips for Sharing Findings

- Talk to members of your target audience early in the project to find out what information they will need and how they will use it. Carefully hone communications products to meet these needs.
- People often like levels of information that allow them to quickly get a sense of the findings and then explore deeper.
  - Concise, easy-to-read, jargon-free summaries of key findings are a good starting level for most people. A short, well-written, and nicely illustrated introductory piece has more impact than a dense 200-page tome.
  - Longer reports focused on the project themes can provide deeper levels of information. Many people seek out a longer report after reading an introductory piece.
- Consider using a combination of print and Web to provide maximum exposure for your results. Some types of information, such as lengthy pieces of text, might best be presented in printed documents, while other information might work best on the Web, such as interactive maps or online databases. Printed documents are easy to mail and hand out to the target audience. Web pages can be less expensive to produce and offer on-demand access to anyone. Documents that are available as downloadable files combine benefits of print and electronic distribution.
- Eye-catching images and graphic design are essential. They grab people's attention and draw them into the deeper information levels. In addition, a well-designed map, graph, or illustration conveys much information quickly. For example, maps produced with geographic information systems (GIS) can be quite useful for presenting information from marine area characterization projects (see page 29).
- Avoid dense, text-heavy publications in favor of graphics-rich, attractively designed documents. Style isn't more important than substance, but style gets people to notice the substance.
- Be clear about who owns the project data. Resolve concerns early in the project by developing a data ownership and sharing agreement signed by project participants. This agreement can influence how data are collected and presented.

### Looking Ahead: Update with New Data and Findings

A marine area characterization is a snapshot that eventually can be updated to reflect changes in the marine area. Moreover, any characterization project is likely to raise as many questions as it answers. The original characterization, however, can create a solid foundation for future research and monitoring projects that reveal new insights and explore new questions about the marine area.



# The Basics: An Introduction to Geographic Information

BY STEPHEN ENGLE *Director, Center for Community GIS*

## What is geotechnology?

Over the last 30 years, developments in geotechnology have created new opportunities for organizations to integrate, visualize, and analyze environmental information. Currently available digital mapping tools—ranging from free, Internet-driven programs like Google Earth to high-end Geographic Information Systems (GIS) software—make it possible for users to customize maps, investigate patterns and trends, and prepare for future events. Today, the range of geotechnology users includes not only scientists, natural resource managers, and professional planners but local conservation groups, police departments, real estate brokers, schools, and 4-H Clubs.

## What is GIS?

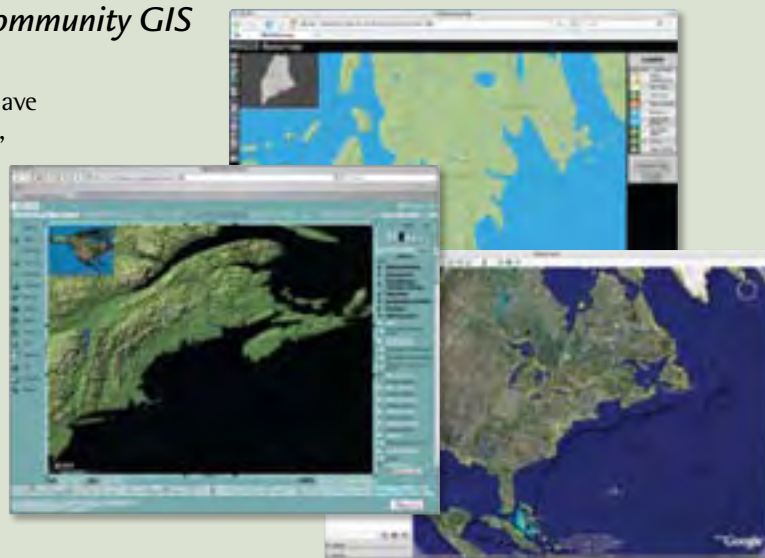
Using GIS, one can integrate layers of geographic information according to their shared geography, regardless of the data source. Layers that are commonly overlaid in a GIS include elevation, hydrological features, roads, land use and land cover, aerial photographs, and satellite imagery. Once the data are entered, GIS users can manipulate all data layers to generate customized maps for a region, look for patterns in mapped features, or create new information by processing one or more of the existing layers. In the marine environment, GIS is being used to produce and distribute detailed nautical charts, track sightings of threatened and endangered species, assess the potential impacts of sea-level rise, describe the locations of habitats, and determine the most suitable locations for marine reserves.

## Where can I find GIS data?

GIS has become a widely used medium for gathering, storing, and exchanging environmental information. Data stored within one GIS database can be shared easily with other GIS users. In the United States, a wide variety of GIS-ready data sets can be accessed from national, state, and regional organizations at no or low cost. Many government agencies (e.g., NOAA, USGS, U.S. Census Bureau) have dedicated GIS departments that are tasked with developing, maintaining, and sharing essential data layers. The number of municipalities using GIS is growing every day, creating new opportunities for GIS users to obtain highly detailed city- and town-scale data sets, such as property parcels. Many of these data providers can also supply maps of their data sets in file formats (e.g., PDF, JPEG) that can be viewed by people without GIS.

## How can I create my own GIS data layers?

In spite of the growing body of GIS data sets, it is not uncommon to find that certain data layers do not exist in digital form or do not possess a suitable level of detail. For local analyses, in-field data gathering has been facilitated by the increased diffusion and affordability of Global Positioning Systems (GPS). GPS data can be integrated easily into GIS to



deepen our understanding of the local environment. Data layers can also be created by tracing features from aerial photographs or scanned paper maps. Sketch mapping on charts and maps is another approach for gathering specialized information from locally knowledgeable people, such as fishermen, harbor masters, tourism operators, and long-time residents.

## How can I start mapping marine issues of importance to me?

Like many information technologies, GIS has become easier to use and more affordable over time. Developing effective GIS capacity, however, remains a significant investment, especially for groups that only use the technology occasionally. For basic mapping needs, a variety of Web tools allow users to generate basic maps of areas featuring transportation networks, political boundaries, demographic information and, in some places, aerial images. Some mapping Web sites and freely available programs allow users to add their own information, such as GPS waypoints or tracks, to the map. Groups requiring more-specialized GIS services can get support from a growing network of dedicated GIS service providers.

## Where can I find some mapping tools and data?

### A Internet mapping sites (capable of generating base maps)

Google Maps: <http://maps.google.com>

Microsoft Virtual Earth: <http://maps.live.com>

MapQuest: <http://www.mapquest.com>

### B Internet mapping sites (content specific)

USGS National Map: <http://nationalmap.gov>

U.S. Census: <http://factfinder.census.gov>

Gulf of Maine Council on the Marine Environment:  
<http://www.gulfofmaine.org>

Gulf of Maine Ocean Observing System: <http://www.gomoos.org>

# Systems (GIS)

## An Example of GIS for Marine Area Characterization: Muscongus Bay, Maine

**Where** Muscongus Bay is located at the midpoint of Maine's coastline, just west of Penobscot Bay. St. George, Friendship, and Bristol are three of its nine mainland towns.

**Who** Quebec-Labrador Foundation, Inc., and the Muscongus Bay Project Steering Committee.

**Why** The Muscongus Bay Project formed in 2003 in response to concerns about the future of the bay's fisheries and the impacts of changing land use and ownership. A review of scientific papers revealed major information gaps about the bay. To help fill these holes, the group began using GIS mapping in 2005, as part of a state-funded bay management pilot study. The group found that GIS was an effective tool for compiling diverse data about the bay and for making custom maps to communicate information about the bay's environment and human uses.

**How** Working with a GIS service center with marine expertise—The Center for Community GIS in Farmington, Maine—the Muscongus Bay Project was able to bring together a vast amount of information in a comprehensive geo-library. The Center for Community GIS and QLF built this master GIS database by:

- downloading existing digital data from online GIS catalogs maintained by organizations, such as the Maine Office of GIS;
- requesting data from organizations that use GIS, including land trusts, universities, and government agencies;
- gathering geographic information that needed to be digitized and imported into GIS (e.g., sites described by latitude and longitude, copies of printed maps);
- collecting new data with GPS;
- facilitating participatory mapping activities with local people to document information that previously had never been mapped (e.g., fishermen's descriptions of fishing grounds, important areas used for water-based recreation); and
- engaging local people in the review and revision of draft GIS maps.

A major product of these efforts is the Muscongus Bay Atlas, a collection of 23 annotated maps built from more than 150 layers of data. The atlas is available at [www.qlf.org](http://www.qlf.org) or [www.community-gis.org](http://www.community-gis.org). The Muscongus Bay Project now has its own library of digital data (stored and managed by the Center for Community GIS) that it can use, share, or augment to create new maps and update existing ones. The group plans to use the customized maps to understand how the bay's ecosystem functions and to support a baywide outreach program to help revive a shared regional identity among the bay's communities and residents.



### C Virtual globes

Google Earth: <http://earth.google.com>

NASA World Wind: <http://worldwind.arc.nasa.gov>

Microsoft Virtual Earth 3-D: <http://maps.live.com>

### D Free GIS programs

ArcGIS Explorer: <http://www.esri.com/software/arcgis/explorer/index.html>

Geographic Resources Analysis Support System (GRASS): <http://grass.itc.it>

TatukGIS: <http://www.tatukgis.com>

### E Online GIS data providers

Geography Network: <http://www.geographynetwork.com>

GIS Data Depot: <http://data.geocomm.com>

Maine Office of GIS: <http://apollo.ogis.state.me.us>

### F Nonprofit GIS service providers

Center for Community GIS: [www.qlf.org](http://www.qlf.org) or <http://www.community-gis.org>

GreenInfo Network: <http://www.greeninfo.org>

Sheepscot Valley Conservation Association: [http://www.sheepscot.org/gis\\_page.html](http://www.sheepscot.org/gis_page.html)



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