

Guidebook to Participatory Mapping of Ocean Uses



NOAA Office for Coastal Management

2234 South Hobson Avenue

Charleston, SC 29405-2413

www.csc.noaa.gov

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About This Publication

The ocean is a busy place, and it is getting busier every day. Understanding the many ways we use the ocean is essential to making sound and effective coastal management decisions. The National Oceanic and Atmospheric Administration (NOAA) participatory mapping process has been developed to fill critical data needs for marine planning by engaging ocean use communities to document their expert knowledge about ocean use activities. The original process was pioneered by NOAA's Marine Protected Areas Center in 2008 and has been adapted and modified in a series of projects across the U.S. designed to address various marine planning data needs. This manual offers guidance through best practices and lessons learned for those interested in applying NOAA's participatory method to collect information on ocean uses from coastal and ocean stakeholder communities. For more information on the process and case studies where it has been applied, please visit www.marinecadastre.gov/oceanuses.

About the NOAA Office for Coastal Management

NOAA's Office for Coastal Management works at the center of the nation's coastal management efforts. From implementing the National Coastal Zone Management Program to providing technical assistance to coastal communities through the Digital Coast, the organization strives to help the nation's coastal communities prosper in the face of numerous natural and man-made challenges. This publication, *Guidebook to Participatory Mapping of Ocean Uses*, represents just one of the many products and services developed for this purpose. To learn more, visit the website at www.coast.noaa.gov.

Table of Contents

Introduction.....	1
Why Ocean Uses?.....	2
Mapping Ocean Uses with PGIS.....	2
NOAA’s Participatory GIS Mapping Method	3
Phase 1: Preplanning	5
Project Scoping.....	5
Budget Planning.....	6
Selecting Staff.....	7
Phase 2: Designing the Workshop	9
Initial Outreach	10
Workshop Logistics	10
Identifying Participants	10
Venue Logistics.....	11
Preparing Workshop Documents	12
Data and Equipment Preparation	13
Digital Base Map	13
Equipment.....	15
Phase 3: Implementing the Workshop	17
Staff Roles	17
Room Setup.....	19
Staff Training.....	19
The Day of the Workshop	21
Breakout Groups	22
Mapping Uses	22
Daily Debrief.....	24
Phase 4: Process and Analyze Data	25
Data Compilation and Review	25
Data Processing	26
Phase 5: Data Validation and Publication	29
Data Validation.....	29
Final Packaging and Distribution.....	30
Summary.....	31

Introduction

Conducting a participatory mapping project can be a rewarding and exhilarating experience that fills critical data gaps and creates a sense of community, if the project is well planned and managed. This document offers step-by-step guidelines—proven techniques—to assist in the planning, implementation, and overall success of a participatory mapping project intended to capture ocean use data. Beginning with a general overview of participatory geographic information system (GIS) methods, the guide then addresses the phases of an ocean use mapping project in terms of 1) preplanning and logistics, 2) designing the workshop, 3) implementing the workshop, 4) data processing and analysis, and 5) outreach and integration, and finishes with a summary of key lessons learned. Throughout the document, critical action items, tricks of the trade, and reference materials supplement each step in the planning and implementation process. This guide strives to demonstrate the attention to detail required for the “participatory” human dimension, as well as the data required for success.

 Overview

 Tips

 Checklist

The icons above are used throughout the document to organize information into specific categories. Each phase of the project addresses these categories individually while also including links to relevant sample documents and products. The checklist refers to key action items to be completed during that phase.



Why Ocean Uses?

The ocean is crowded. Human uses of our ocean, coasts, and Great Lakes are expanding at a rate that challenges our ability to plan and manage them under traditional approaches. At the same time, managers and planners lack continuous, comprehensive, consistent, and comparable data to understand even the most basic aspects of ocean uses. As traditional uses expand and new uses emerge, ocean use data are becoming increasingly indispensable for a range of applications. These include, but are not limited to, energy siting, emergency response, assessment and restoration, planning for sustainable use, economic valuation, climate change adaptation, and efficient investment and outreach. Increasingly, communities, managers, and planners are realizing that having a better understanding of where and how people use the ocean is foundational for better decision-making.

Mapping Ocean Uses with PGIS

Participatory GIS, or PGIS, is a term that has evolved to describe the use of modern mapping technologies and methods to spatially document community knowledge about places. PGIS has become widely accepted as a useful means of contributing spatial data to support decision-making processes. Participatory methods combine a wide range of tools and approaches, from paper sketch maps to aerial and satellite imagery, the Global Positioning System, and GIS.

This document will focus on the use of PGIS to understand ocean uses, an essential component of successful marine resource planning and management. Unfortunately, spatial data on ocean uses are often limited, since use patterns are often qualitative, not comprehensive, incomparable, subjective, and difficult to capture consistently over large areas. Additionally, knowledge of ocean use patterns is often held by a small number of individuals who routinely observe the coastal and marine environment and the activities occurring therein. Emerging PGIS processes are providing new, interactive ways to tap critical local knowledge and capture ocean use patterns through the application of specialized GIS mapping tools.

NOAA's Participatory GIS Mapping Method

Since 2007, The National Oceanic and Atmospheric Administration (NOAA) has been pioneering, developing, and refining its own application of PGIS to capture ocean use patterns. Working with various partners, NOAA staff members have led participatory mapping efforts throughout the U.S. Nearly 30 distinct ocean uses at multiple scales, across different domains, and for a variety of marine management applications have been documented.

Through NOAA's PGIS process, local and regional experts work together in an interactive workshop setting to create maps that document how communities use the ocean. Before the workshops, regional research is conducted to profile the types and categories of uses that occur in the study area, and to explicitly define the targeted uses to be mapped. Meetings with project partners, resource managers, local regulatory agencies, and key stakeholders are also conducted to refine the scope of the mapping effort and identify appropriate mapping scales. The meetings ensure that uses are prioritized according to their relevance to current ocean management issues and given appropriate definitions.

Through the initial project scoping and outreach phase, workshop participants with knowledge of the coastal and marine environment, as well as experience with the targeted use, are identified. At the workshops, participants are briefed on the objectives and equipment, separated into groups, and assigned the task of mapping ocean uses as a team. In each group, a process facilitator and GIS facilitator lead the participants through the mapping process, record notes on group discussions, and provide technical and process support. GIS-based maps of the study region are projected, and participants are asked to draw use-area polygons directly onto the projected map with a pen that transmits the data directly into the whiteboard surface, which is captured into the GIS. After each use is mapped, the participants have the opportunity to view their results and refine ocean use patterns through group discussion and deliberation.



After the workshops, the data from the breakout groups are compiled, reviewed, and processed to create a unique data layer for each use. Notes gathered during the workshops are reviewed and consulted to clarify any observed data inconsistencies. A detailed data-processing workflow is followed with decision rules to assist in tracking the data editing and process steps involved in the compilation of the draft data. Upon completion of the initial data processing, draft data and maps are returned to the workshop participants for review and feedback. Comments received during the review process are documented and addressed to create the final products. The final versions of the GIS data, metadata, maps, and related analytical products are then compiled and published online. The final stage of NOAA's PGIS effort involves outreach to the participants, potential clients, and data users to share the results of the mapping workshops. This is achieved through webinars, conference presentations, and onsite meetings with participants.

The process is intended to be a flexible approach that can be refined and adapted for any region or domain to address multi-scaled management decisions. The remainder of this guide details the main steps in the process, along with key action items, sample materials, and tips garnered through years of experience.

Phase 1: Preplanning

🔄 Overview

The first phase of a PGIS project should focus on project scoping, budget planning (for time and money), and identifying staff members needed to complete the workshop.

☑ Checklist

In this phase of the project, be sure to

- Define study area and mapping goals
- Clarify project objectives and data applications
- Identify partners
- Confirm funding, time, and limitations
- Determine partner roles and responsibilities
- Meet with local stakeholders to promote the project

Project Scoping

Ideally, project scoping should begin months in advance of the workshop to ensure that key participants can attend, facilities and accommodations will be available, and project staff members have sufficient time to prepare (Appendix 1-1). Depending on the number of workshops and participants involved, as well as the preparation workload, six months before the workshop date is a good rule for beginning the planning process. Appropriate project partners from federal, state, local, and private organizations should be considered. When a partnership is established, roles and responsibilities of each should be determined. Project partners should also determine the overarching project goals and how the data will ultimately be used and housed. Data applications will shape the final products to be delivered, which should also be covered in this step. Roles and responsibilities of each partner as well as funding limitations should be outlined. This step in the preplanning process should include defining the study area boundaries, and determining the target list of uses (Appendix 1-4), sectors and scales to be mapped, and any other information to be collected in the workshop. As the project scope begins to take shape, project leads should also consult with key user groups, stakeholders, and resource managers to foster community support for the project and generate an initial list of potential workshop participants.

Helpful Hint: Six months before the workshop date is a good time to start the planning process.

⊗ TIPS

- Ensure that the list of uses reflects the most pressing ocean use management issues for the region.
- Consider how much workshop time will be spent on the mapping exercise, and make sure that the mapping goals are realistic.
- Consult with local experts, managers, or select stakeholders to verify that the target uses are appropriate and accurately defined. Decide on the level of detail for use categories. An example might be to map each fishing use by species or gear type.
- Be mindful of how much time it might take for planning, since each project is different.
- Determine the number of meetings and the timing of those meetings by using the feedback received during the scoping.
- Refer to the timeline for detailed information.

Budget Planning

Early in the project, it is essential to consider the financial commitment required to achieve project goals. Draft a budget and identify areas of flexibility given the partner contributions, in-kind support, and optional costs (Appendix 1-3). Budgets should address the costs for staff time and travel, venue and catering expenses, participant travel, workshop supplies and incidentals, and any overhead costs. Depending on the nature of the partnerships and collaborators involved, various aspects of the project can be altered to reduce costs. For example, if a partnering agency can contribute in-kind staff time, project costs may be significantly reduced. Additional budget considerations include the size of the area to be mapped, number of workshop days, number of participants, travel logistics, and whether participants will be housed overnight. Be mindful of travel costs for staff members as well. Travel can be a large percentage of the budget when airfare, hotel, and per diem rates are added in. To help cut costs, determine where there is flexibility in planning.

⊗ TIPS

- Reduce costs through mechanisms such as in-kind support for space, strategic travel planning, and participant grouping or venue siting to reduce the number of individuals who need to travel or stay overnight.
- Consider what equipment is needed, what is available, and what needs to be purchased or could be borrowed.
- Consider potential workshop dates and venues, since prices may vary by location or dates.
- Refer to the budget considerations document for more information on budgets.

Selecting Staff

It is important to estimate staff needs in advance and secure the right people to provide workshop support. Selecting staff members based on their proximity to the meeting location will not only cut back on the budget, but those staff members may be more aware of local needs and concerns.

Helpful Hint: Consider recruiting students to take notes and help with other logistics in order to keep costs low.

There are usually six or seven separate roles for staff members throughout the life of the project, depending on project needs. During a workshop, each breakout group will require two dedicated staff members, a GIS facilitator and a process facilitator. The number of participants will determine how many breakout groups are needed. Ensure that staff schedules can accommodate the time and that the budget can support necessary travel costs. The following list describes the primary staff roles.

- Project lead – responsible for managing all aspects of the workshop, and serves as the primary point of contact for staff
- Coordination staff – responsible for the workshop logistics, participant registration, caterers, and venue details
- Technical GIS lead – responsible for managing data collection, developing a base map, post-processing data, and creating final data products
- Process facilitators – control the workflow and group dynamics in the breakout groups during the workshop
- GIS facilitators – responsible for running ArcGIS during the workshop and guiding participants through the base map; may also be assigned post-processing tasks
- Note takers – can be incredibly helpful, but could be omitted if cost is an issue

⊗ TIPS

- When resources allow, it is advisable to have a designated local expert to assist in the planning process, help with outreach, and deliver a consistent message about the project and its intended objectives and applications. A locally based coordinator can enhance the identification and engagement of local participants and provide logistical insight.
- If resources allow, it is helpful to have a separate and dedicated note taker. Consider recruiting students at partner universities to help with notes and other general support.
- Some staff members may be able to fulfill multiple roles depending on their skills.

Phase 2: Designing the Workshop

Overview

The second phase of the project should be dedicated to designing the mapping workshops. This phase of workshop planning should start as soon as funding has been committed and enough information has been gathered in the initial project planning phase. At this point, outreach and communication with potential stakeholders will begin and continue through the workshop. This phase includes developing initial outreach products and invitation lists and identifying venues and catering options. During the design phase, workshop documents, data, and equipment will also be compiled. Workshop preparation can begin as soon as the scoping and budget have been completed. This step usually continues right up to the day of the workshop.

Checklist

Six to nine months in advance,

- Create initial outreach documents (Appendix 1-2)
- Create tracking spreadsheets for participant contacts and responses (Appendix 2-3)
- Explore potential venue locations, costs, dates, and catering options
- Confirm initial list of referrals and potential participants
- Estimate number of participants expected to attend
- Estimate participant travel costs
- Confirm staffing needs and consider staff travel costs
- Identify and secure workshop staff

One month in advance,

- Verify schedules and travel costs for staff

Two weeks in advance,

- Compile and print digital base map and paper maps
- Copy all data to all laptops and external drives
- Organize shipping and transportation of equipment and materials
- Collect and prepare all workshop supplies
- Test and ship all technology and prepare backup set

For more details on the timeline, visit Appendix 1-1.

Initial Outreach

Convincing members of the community or stakeholders that represent sensitive use sectors (such as local fishermen) to participate in mapping workshops can be difficult. One way to earn trust is to create outreach products early in the project that describe how the data will be used, how it could be beneficial to stakeholders, and show how the scale and mapping process are designed to protect proprietary information (Appendix 1-2). Working with the project partners and coordinator to contact organizations early can help with buy-in on project outcomes and uses being mapped.

Workshop Logistics

Depending on the project scope, it is a good idea to plan for a certain number of attendees for each day of the workshop. This will help in siting venues, budgeting for catering, and estimating staff needs. To do this, consider the scope of what will be mapped each day, including whether all uses or just a select set or sector will be mapped each day, the number of uses overall, and the number of participants that should be present in each group. Usually, a good target is 10 to 12 people per breakout group, with a maximum of three breakout groups each day. Each breakout group will require two dedicated staff members, a GIS lead and a process facilitator. It is important to estimate staff needs in advance and secure the right people to provide workshop support. At this stage, consider staff needs and availability. It will also be important to consider the costs for staff members (and participants) to travel and attend the workshops according to the location and state or federal per diem.

Helpful Hint: A good target for breakout groups is 10 to 12 people.

Identifying Participants

The key to the success of the participatory process is the identification and participation of the appropriate experts, stakeholders, or use practitioners. The participant search should begin as the project scope is finalized and the list of uses is confirmed, and should include a referral phase and an invitation phase. The referral phase is the first step toward identifying the key individuals who would likely have the knowledge to support the mapping effort. Start by creating a list of local and regional stakeholders, organizations, businesses, regulatory agencies, and institutions that focus on coastal and marine issues, processes, or activities (Appendix 2-1). When available, name specific individuals or research online to acquire a point of contact. Send an email to these contacts to introduce the project, its scope, and targeted uses, and to request their assistance in referrals for potential workshop candidates (Appendix 2-2). As the referrals are received, begin to consider timing of workshops, venues, and potential lodging options, if needed.

Table 1. Potential stakeholder or community groups that could be candidates for invitation to ocean use mapping workshops

Charter operators	Coastal homeowners
Federal agency officials	Fish and game wardens
Harbor masters	Law enforcement agents
Lifeguards	Local fishermen
Local nongovernmental organization representatives	Marine business operators
Military representatives	Naturalists and docents
Park managers	Resort managers
Scientists and researchers	Traditional practitioners
Tribal council representatives	Watermen/women

With responses from the referral phase, a more complete list of potential participants is compiled and thus begins the invitation phase. The next round of emails is sent to the developing list of potential participants and includes the project background as well as a formal invitation to attend the workshop. Additionally, invitees are asked to define their use knowledge and geographic area of expertise. The following few weeks and months involve tracking responses, building the participant database (which lists confirmed participants, use and geographic expertise, contact information, and communication tracking), and following up with ongoing referrals (Appendix 2-3). This continues until there are enough confirmed participants for all targeted use categories.

Helpful Hint: Provide official invitations at least two months in advance of the workshops to secure availability of participants.

Plan to follow up on referrals and invitations with an email or phone call. Call all participants the week before the workshops to remind them of the logistics, answer any final questions, and confirm attendance.

Venue Logistics

While the participants are being identified and contacted, it is essential to commit to the venue, lodging, and catering details. Consider options in the targeted geographic area such as community centers and academic institutions to match available funding. Also consider the number of participants anticipated to attend each day and the planned number of breakout groups when looking for venues to secure adequate space with separate rooms or sound dividers, provide parking and basic technology services (power, Internet, and cell phone service), and have flexible room configurations (i.e. can move tables, chairs, etc.). If whiteboard technology will be used, it may be wise to test the room for digital interference or have backup options available (e.g., poster board). Often, schools, community centers, or other public meeting facilities have more flexibility and are more affordable than hotels or other conference facilities.

Finally, do some research on catering options and decide what option best fits the budget and food service needs. A light continental breakfast is optional, but lunch is a must and can be boxed and delivered instead of provided buffet-style to cut down on costs. Coffee, water, snacks, and other beverages are essential to keep the participants fueled throughout the day.

⊗ TIPS

- Ship workshop materials well in advance depending on location.
- Arrange travel plans for all staff members and participants in advance and coordinate timing to save on transportation and accommodation costs.
- Ensure that rooms have dividers (if two breakout groups will occupy same space) and enough accessible power outlets.
- Test equipment in the actual workshop rooms in advance of the workshop. Ensure that the lighting, room setup, and equipment work adequately in the space.
- Arrange box lunches instead of a buffet to cut costs.
- Ask about attendees' dietary needs in confirmation emails.
- Hire a locally based coordinator who can enhance the identification and engagement of local participants and provide logistical insight (if budget allows).

Preparing Workshop Documents

Various types of documents should be compiled to assist in outreach and organization throughout the mapping project. The following list describes some documents that are useful resources for both workshop staff members and participants. See Appendix 2-4 for a more complete list of documents.

Participant Documents	
Project Fact Sheet	Outreach document that summarizes the project and identifies the target geography and list of uses, partners, schedule, products, and project lead contacts (Appendix 1-2)
Workshop Agenda	The schedule for each day of the workshop
Study Area Map	A graphic that clearly shows the boundaries of the study area
Uses List and Definitions	A detailed list of the uses to be mapped during the workshop and the description of these uses (Appendix 1-4)
Instructions for Participants	Simplified description of how the uses will be mapped (Appendix 2-5)
Form for Additional Information	Allows participants to provide supplemental information on uses being mapped (Appendix 1-4)
Workshop Evaluation	Allows participants to provide feedback on the workshop (Appendix 2-6)
Reimbursement Form	Needed only if funds are available to cover participant travel expenses (Appendix 2-7)
Name Tag or Name Tent	

Staff Documents	
Staff List	An internal form that provides roles and contact information for all staff members involved in the workshop
Workshop Daily Overview	Outlines the daily workflow for the workshop and offers key reminders for each phase
Uses List and Definitions	Detailed list of the uses to be mapped during the workshop and the description of these uses, (optionally) coded to identify the order of uses to be mapped for each breakout group (Appendix 1-4)
Instructions for Facilitators	Brief description of the main steps required to run the process facilitation (Appendix 2-9)
Instructions for GIS staff	Brief description of the main steps required to run the GIS components of the workshop (Appendix 2-10).
Technical Tutorial	Simple technical guide that explains how to use the mapping software to collect the spatial ocean use data (Appendix 2-11)
Notes Template	Template used by facilitators and GIS staff members throughout the mapping exercise to record notes for each use mapped (Appendix 2-12)

⊗ TIPS

- Compile materials in advance of the workshop into separate folders for participants and staff members. Additional materials that may be provided to staff members include a list of participants and their affiliations or areas of expertise (coded by breakout group), and an ordered list of uses to map each day in each group.
- Before the workshop, it is useful to assign each breakout group a specific color for each day (i.e. blue Tuesday). That way, all data, notes, equipment, and evaluations can be color coded to ensure that they can be traced back to the appropriate group after the workshop. Participant and staff name tags, as well as room signs, can also be color coded to assist participants in identifying the staff member and location for their assigned breakout group.

Data and Equipment Preparation

This step of the project focuses on preparing the data and technology for the workshop. The workshop is the key to the entire mapping process and its success relies heavily upon advanced preparation and planning by the project staff. In order for participants to successfully delineate use areas during the workshops, they will need to have resources available to assist them in accurately plotting areas on a map.

Digital Base Map

The digital base map is the template that participants use to document use areas. It is essential that the base map provide enough information to assist participants in mapping uses without being overly detailed. Workshop participants will use various sorts of geographic points of reference to locate themselves spatially on a map, so it is important to build base maps that provide as many reference layers as is reasonable to meet diverse needs (e.g., boat-based fisherman tend to prefer nautical charts versus hill-shaded bathymetry, whereas lifeguards and park managers tend to rely on coastal access points and trails for reference). Prepare the base map with multiple base layer options that are well labeled and symbolized at the designated mapping scale (e.g., boundaries, ports and harbors, buoys, coastal access points, roads, submarine features, cities and towns, hotels, landmarks, beaches, bays, parks, and marine protected areas). Additionally, it is always useful to have high-resolution aerial or satellite imagery of the shoreline, as well as digital raster graphics or topographic grids of the terrestrial coastal environment to provide additional spatial reference.

Choose base layers wisely; more is not always better. Often, more time is spent discussing the inaccuracies of existing data than the intended mapping of the uses, so try to avoid using base data that are old, incomplete or non-authoritative. Have a local partner review the base map to pick out incorrect labels, or add in more recognizable names or features of interest.

Printed maps are also useful for individuals who prefer the hard-copy map to the digital version. Create paper maps of the study region at the designated mapping scale, send them to participants in advance with their invitation, and provide additional hard-copy maps in the breakout groups. Wall maps of the study area plotted in large format are also useful resources for group discussions and reference at the workshop.

Equipment

The primary mapping equipment needed for a PGIS project includes a laptop (loaded with GIS software), digital whiteboard technology (eBeam), and a digital projector. Other equipment can be useful, but these are the primary components.



The mapping equipment must be prepared and verified to test the software and peripherals and to ensure that the systems are current. Depending on the applications used to gather the use data, these tools should be tested on all systems in advance of the workshops. All peripherals should be inspected (laptop, projector, digital tablet, and whiteboard technology), and extra cables, duct tape, batteries, and projector bulbs should be included in the workshop hardware kit. An additional set of equipment should also be available as an alternate or backup in case any part of the system should fail in a breakout group.

It is also important to consider transportation of materials and equipment to the workshop venue. Explore costs and timing for shipping options, consider what items can be carried by staff members, and remember to think about the return transportation as well. As part of this step, it is important to consider who will staff the workshop, their availability, and associated costs and management of travel.

⊗ TIPS

- Designate a technical lead for the project.
- Capitalize on existing data for base map compilation.
- Create an equipment checklist (Appendix 2-13).
- Test all equipment and prepare backups.
- Ship materials well in advance depending on location.
- Plan ahead since material preparation can take a few weeks.
- Make extra copies of all printed materials.

Phase 3: Implementing the Workshop

Overview

This section focuses on the work of actually implementing the workshop, including confirmation of staff members, staff training, workshop setup, and running the workshop.

Checklist

- Clarify staff member roles and breakout teams
- Set up and test equipment, secure cables, and clear walkways
- Have backup equipment and batteries ready and accessible
- Ensure that breakout rooms can be secured overnight
- Review workshop documents and mapping station setups
- Discuss confirmed participants and breakout group plan
- Demonstrate technology and use mapping example
- Provide guidance for frequently asked questions and technical mishaps
- Offer tips on people management

Staff Roles

There are usually four roles for staff members during an ocean use mapping workshop: project lead, GIS specialist, process facilitator, and project coordinator. The project lead is responsible for managing all aspects of the workshop and is usually the primary point of contact for workshop staff members. GIS leads are tasked with managing the data collection, while the process facilitators control the workflow and group dynamics in the breakout groups. The project coordinator is responsible for the workshop logistics, participant registration, and catering and venue details.

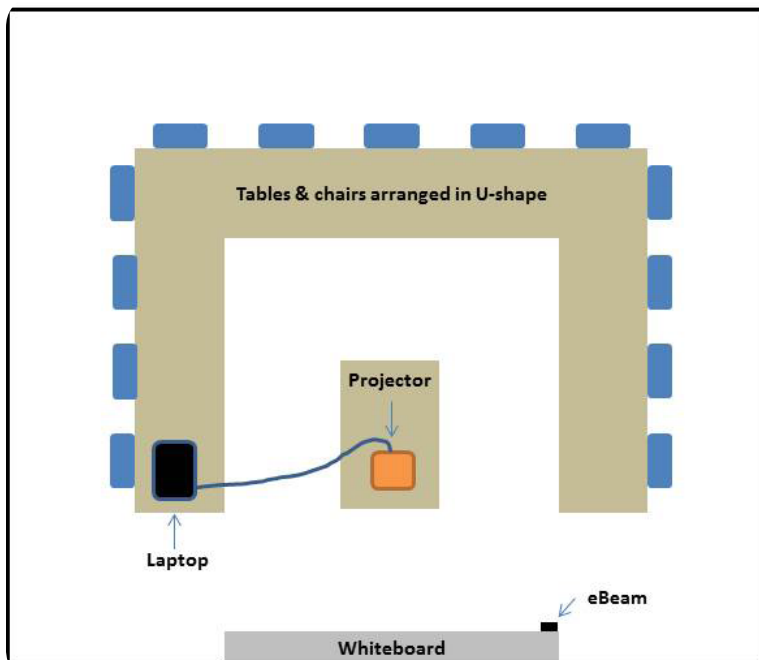
Each day of the workshop requires attention to both the technical and social details. While the technology and equipment must be functional to capture the uses data, it is also essential that the participants feel respected and that their insights and opinions matter. Below is a checklist of items that should be completed for each day of the workshop.

Task	Staff			
	Project Lead	Project Coordinator	Process Facilitator	GIS Specialist
Greet participants upon arrival with name tag and workshop folder	X			
Present project background to all participants	X			
Review the agenda, venue logistics, and lunch plan	X			
Break out into groups and do individual introductions	X	X	X	X
Introduce the mapping process, the materials, and the equipment (Appendix 2-9)			X	
Run a demo with participants to test the tools (Appendix 2-9)			X	X
Map uses each breakout group (Appendix 2-11, 3-1)			X	X
Take detailed notes on discussion, issues, and controversies (Appendix 2-12)			X	
Save data to thumb drive at breaks and lunch				X
Provide time for evaluation (Appendix 2-6)			X	
Thank participants in advance at the lunch break	X		X	
Collect evaluations and use questionnaires (Appendix 2-6, 1-4)			X	
Meet to debrief and follow up on the day's events	X	X	X	X

Room Setup

The day before the workshop, designate a few hours to set up the workshop venue and run a staff training session. Check with the venue staff to see if the venue will be available the night before the workshop for setup. Setup tasks include configuring the breakout room layout, organizing tables and chairs, setting up hardware, hanging maps and signs, preparing the registration area and materials, and testing all equipment and connections.

The largest room should be set up for the introductory presentation, where the workshop participants will convene to meet the staff and learn about the project. This space should initially be arranged to accommodate all participants in a theatre configuration with all chairs facing front, but this room may also need to double as a breakout room.



Each breakout room should each be equipped with a computer (with thumb drive or external hard drive), a projector, a digital whiteboard (eBeam), a digital tablet (optional), and all related cables. The tables should be arranged in U-shaped configuration with the projector on a separate table inside the horseshoe to avoid getting knocked or bumped. The digital tablet should be placed in an accessible location where participants can freely access it.

Staff Training

Once the venue is prepared, the project coordinator should spend a few hours training new and returning staff members on the project objectives, workshop process, and equipment. This training can be relatively informal but should include orientation to the study region and uses list, discussion of roles and responsibilities, and instruction (refresher) on the use of workshop equipment and materials.

Helpful Hint: Be sure all staff members fully understand the uses and differences among them.

It can be helpful to create a training packet that includes the following documents.

Staff Documents	
Staff List	An internal form that provides roles and contact information for all staff members involved in the workshop
Workshop Daily Overview	Outlines the daily workflow for the workshop and offers key reminders for each phase
Uses List and Definitions	Detailed list of the uses to be mapped during the workshop and the description of these uses, (optionally) coded to identify the order of uses to be mapped for each breakout group (Appendix 1-4)
Instructions for Facilitators	Brief description of the main steps required to run the process facilitation (Appendix 2-9)
Instructions for GIS staff members	Brief description of the main steps required to run the GIS components of the workshop (Appendix 2-10)
Technical Tutorial	Simple technical guide that explains how to use the mapping software to collect the spatial ocean use data (Appendix 2-11)
Notes Templates and Binders	Template used by facilitators and GIS specialists throughout the mapping exercise to record notes for each use mapped (Appendix 2-12)

During the training, remind staff members of their roles and responsibilities and the chain of command (who to contact if problems arise), review staff binders and documents, discuss the list of confirmed participants and proposed breakout groups, and run through trials with the equipment.

The trainers can offer hindsight from previous mapping experiences, address answers for frequently asked questions and provide tips on both the technical aspects of the workshop and the social facilitation component. Provide ample time for staff members to experiment with the equipment and meet with their breakout group partner to discuss last-minute questions.

Training is usually conducted at the workshop venue the day before the workshop. However, training materials can be provided in advance. Alternatively, training sessions can be conducted separately from the workshop, if time and budgets allow.

⊗ TIPS

- Allow new staff members to observe the equipment setup and room preparation.
- Cater training session duration to the level of experience of the staff.
- Run through a trial mapping exercise for one use.
- Allow new staff members to shadow experienced personnel at the onset of the workshop.
- Ensure that sufficient wall surface is available if whiteboards are not.
- Create a training day package with resources for facilitators.
- Welcome last-minute RSVPs if possible and if that person is essential to the workshop.

The Day of the Workshop

The workshop should proceed in the following phases: registration and check-in, introductory presentation, mapping in breakout groups, wrap-up and debrief.

On the day of the workshop, participants will check in to the registration area and receive their workshop materials (folder or packet) and name tag, coded to the breakout group to which they have been assigned. The participants should be asked to convene in the main conference room for the introductory presentation and offered coffee or continental breakfast. Note that it is useful to have special name tags for staff members so that participants can easily distinguish the staff from other participants. Have additional participant folders and blank registration forms on hand for participants who show up who did not RSVP.

Participant Documents	
Project Fact Sheet	Outreach document that summarizes the project, and identifies the target geography and list of uses, partners, schedule, products, and project lead contacts (Appendix 1-2)
Workshop Agenda	The schedule for each day of the workshop
Study Area Map	A graphic that clearly shows the boundaries of the study area
Uses List and Definitions	A detailed list of the uses to be mapped during the workshop and the description of these uses (Appendix 1-4)
Instructions for Participants	Simplified description of how the uses will be mapped (Appendix 2-5)
Form for additional information	Allows participants to provide supplemental information on uses being mapped (Appendix 1-4)
Workshop Evaluation	Allows participants to provide feedback on the workshop (Appendix 2-6)
Reimbursement Form	Needed only if funds are available to cover participant travel expenses (Appendix 2-7)

Staff members should arrive at least one hour before the participants to make any final preparations, test the equipment, and consult with each other on any last-minute changes.

All participants and staff members should convene at the designated start time (on the agenda) in the main conference room for staff introductions and the project overview presentation. The presentation should be delivered by the project lead and be a brief, succinct outline of the projects' purpose, goals, and objectives. It should also reference key partners, briefly summarize how the resulting data will be used, and set forth the planned timeline for deliverables. To keep to the workshop agenda, it is advised that questions be held until participants convene in their breakout groups, but it may be appropriate to take a limited number of questions immediately after the project presentation.

Before moving into breakout groups, the project coordinator should review the agenda, note the timing of breaks and lunch, and point out the location of restrooms.

Breakout Groups

Participants will be asked to convene in their breakout groups immediately after the introductory presentation. In the agenda, allow some time for people to make this transition and get settled in the breakout rooms. Ensure that breakout room locations are clearly marked and that staff members assist in ushering participants to the right rooms.

Helpful Hint: Having each group map the list of uses in a different order will ensure that all uses are mapped by at least one group. Consider the ocean use knowledge and expertise in each group and order the uses to capture the most relevant uses first.

Once all participants are present, the process facilitator should start with a round of introductions, during which participants say their name, affiliation, and area of expertise. Introductions should include any staff members present, as well as any observers.

After the introductions, the facilitator should also (Appendix 2-9)

- Present a brief review of the folder documents
- Introduce the base map, data layers, and bookmarks
- Provide a quick summary of the mapping exercise
- Demonstrate the mapping equipment, and show common mistakes
- Allow each participant an opportunity to draw a test polygon to get comfortable with the technology, if time permits
- Offer tips and tricks to streamline the process

Once the group has been oriented to the tools and the process, it is time to start mapping uses (Appendix 3-1).

Mapping Uses

To map each use, the facilitator can begin the exercise by introducing the use, reading the use definition (what it includes and excludes), and asking some general questions about the use to get the conversation started. The questions should drive the participants to consider the use pattern. The questions can ask where the use originates (shoreline, harbor, etc.), if it involves transit (fishing, diving from a boat), if it is restricted by depth or distance from shore, or perhaps if the use pattern is related to or driven by other features (e.g., near buoys, piers, or rocky areas). Document the answers to these questions in the notes. Encourage participants to take that knowledge, and document the use pattern on the map, starting with the general use pattern.

Helpful Hint: Remind participants of the definition of general use and dominant use before they begin mapping.

Ask participants to document areas that represent activity areas for each specific ocean use. For some uses, existing data may be presented. Ask participants to review and modify the existing data for completeness and accuracy. For each use presented, ask participants to map the general use footprint and dominant use areas, as described below. Ask participants to provide relevant supplemental information (e.g., seasonality, social and cultural significance, historical patterns) on the use questionnaire.

General use footprint: Includes any area in which the use is known to occur with some regularity (over the past 3 to 5 years), regardless of its frequency or intensity. The general use footprint does not include areas where the use may occur once or twice or where it might conceivably occur now or in the future.

Dominant use areas: Ocean areas routinely used by most users most of the time (within the seasonal patterns for that use). Dominant use areas must be drawn within the general use footprint.

The general use footprint can often include the entire study area for certain uses and is intentionally defined very broadly to get participants thinking about what drives the use pattern. The mapping of the dominant use areas is often a more laborious step, since it is intended to get participants to critically consider the areas within the general use footprint where the use occurs with more frequency. Often this step takes more time and results in smaller areas where the group agrees that the use is pursued more intensely. For some projects, it may also be useful to ask participants to document potential future use areas. This can assist in understanding how the ocean space may be occupied in the future as new and emerging uses evolve.

Helpful Hint: Remind participants that they can include land when drawing ocean use areas that hug the shoreline. The land areas will be clipped out as part of the data processing.

After mapping each use, the group can review the areas drawn and make any final edits. Before moving on to the next use, the facilitator should encourage the group to fill out any additional information about that use on the use questionnaire, while the GIS specialist saves the data layers and prepares the map for the next use.

Other uses are mapped in the same fashion, following the order set for each breakout group for each day of the workshop. As the group progresses through the list of uses, it is common for one use pattern to mirror another that has already been mapped. If that is the case, the GIS specialist can cut and paste from a previously mapped use pattern and allow the group to refine as needed, instead of requiring the group to start again from scratch.

Helpful Hint: If possible, it would be helpful for participants to see a demonstration of a project that used the ocean use data. Plan a demonstration over lunch.

As the group gets familiar with the mapping process, the participants often get more comfortable with the equipment and each use takes less time to document. Ideally, each group will complete all the uses they are assigned, but it is likely that each group will finish at a different time. Please note that the groups should start at different points in the use list to be sure that all uses are mapped. The facilitators can use their best judgment to decide on time for breaks, but all groups should stop at the same time for lunch. Since groups tend to complete the mapping at different times in the afternoon, the project lead should plan a time during the lunch break to thank the participants and encourage their feedback on the evaluation form.



As the group approaches the final uses on the list, it is a good idea to take a quick break and allow people some time to fill out the workshop evaluation form. Often this form also asks if and how participants would like to be informed to review the final data products. Stress the importance of the evaluation as a means of improving the process and ensuring that the products are made available in an appropriate manner. Be sure to thank each participant individually and collect their use questionnaire and evaluation form upon departure.

Data collected from all breakout groups should be saved and cataloged on a separate backup drive upon completion of the mapping exercise.

Daily Debrief

At the end of each workshop day, schedule some time to meet with staff members to debrief and discuss the events of the day. Staff members can present any clarifications or additions to the uses list, as well as discuss any challenges or problems that arose in their breakout groups. As needed, the team may want to modify the process for the following days. This time can also be used to review the plan for the next day, revise the breakout group teams, collect and organize the evaluations and use questionnaires, and make any modifications to the agenda. If the workshop spans multiple days, be sure that computers and data drives are not left at the venue overnight.

Phase 4: Process and Analyze Data

Overview

Once the workshop is completed, the focus shifts toward the processing and analysis of the data collected and the summarizing of results. This section discusses this aspect of the project and includes information on data review, processing, analysis, product development, and data integration. Several options should be considered for post-workshop data processing, some of which can require significant additional time or resource commitments. At a minimum, allow for one month for basic data review and aggregation. Additional validation steps, such as public meetings or webinars, map production, and the creation of custom cartographic products and analyses can greatly increase that estimate.

For a detailed description and instructions of the steps listed below, refer to Appendix 4-1.

Checklist

- Ensure all data and notes are accounted for
- Conduct initial cleaning of data
- Conduct webinar or question and answer sessions with support staff to clarify data, if needed
- Finalize the draft data

Data Compilation and Review

By the end of the workshops, compile all GIS data and staff notes into a single location. The data processor may need to seek input or clarification of notes from the workshop staff for these steps; therefore these steps should be completed as soon as possible after the workshops end.

Depending on the number of breakout groups and workshop days, there can be various spatial data files and note sheets for each use mapped. The GIS specialist who will be responsible for processing the workshop data should create a log of all the data layers and note which groups have mapped each use. Staff notes should be reviewed and any key GIS processing instructions added to the log file. Use questionnaires should be studied and relevant contextual information for each use compiled into a spreadsheet.

After the data and notes have been reviewed and logged, manually review and clean each use data layer. Throughout the mapping exercise, it is common for participants to make small errors that leave artifacts in the final data layer. Although GIS specialists attempt to clean up many of these during the workshop, it is important to conduct a thorough post-workshop review of all the use data. Artifacts may include holes in the middle of shapes, or tails that extend further than the rest of the shape. In some cases, the shapes don't extend completely to the shoreline or to the study boundary and have to be expanded slightly. Lastly, data must also be clipped to exclude any areas on land or areas that are otherwise outside of the study boundary. All areas drawn as dominant must be copied into the footprint.

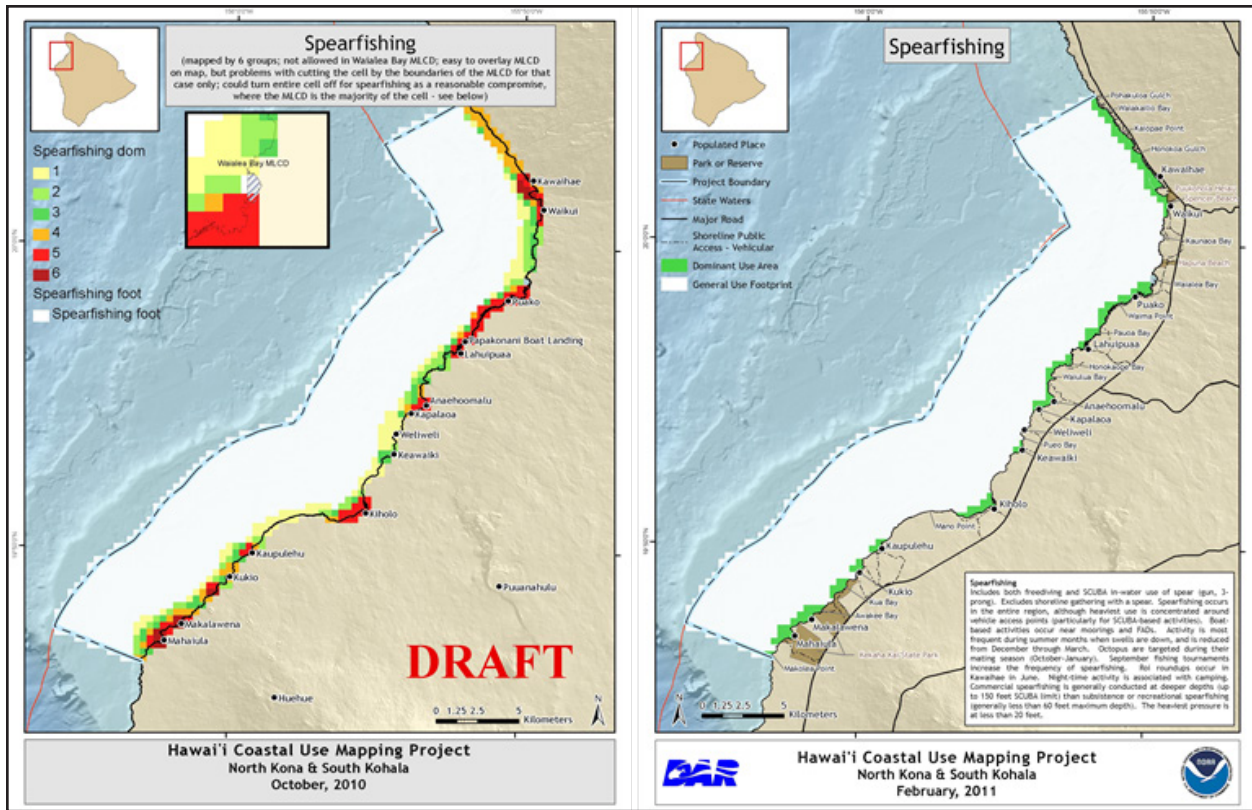
Data Processing

After the data have been compiled and reviewed, the data processor should consult the staff notes and follow any suggested use-specific processing instructions. Throughout the workshop, participants often provide valuable non-spatial information about use patterns that is difficult to document accurately on the projected map. For instance, they may note that a use is restricted to a certain depth or distance from shore, around buoys, or only between certain depth contours. These use-specific insights are captured in the staff notes and are used to guide the post-processing for each use.

Processing questions might arise during this step, so it can be useful to create simple maps showing the question areas and to hold brief meetings or webinars to coordinate with the workshop staff and talk through any processing decisions. In many cases, the multiple inputs by several groups will ultimately reduce the outlying data and can sometimes help to answer a question arising from one group's use data.

Once the use-specific processing is complete, the use data must be aggregated to a common analytical unit to allow for pattern comparison across the study area. Typically, a vector-based grid is used with the grid cell size chosen to best fit the scale of mapping, the geographic scope of the project, and the intended applications of the final data. Occasionally, the size of the grid cell is chosen to match an existing management standard or scale. An empty vector-based grid is created with the specified cell size and used as the template to aggregate the workshop data.

Please note that for each use, there are multiple versions of the spatial pattern, one for each breakout group that mapped the use during the workshop. This data redundancy is intended to evaluate the accuracy of the final data and allows the data analyst to calculate how many groups mapped the same area for the same use. The resulting "heat map" can be useful in visualizing where the breakout groups had the most agreement on a use pattern (see image on left, next page). But to create a single overall use map, the team must decide on a threshold or cut-off that will dictate the level of agreement required for inclusion in the final data set (see image on right, next page).



Traditionally, the use footprint data set does not have a minimum threshold requirement. If any group identified an area as part of the use footprint, it is included in the final data set. However, for the dominant use data layer, the default decision rule is 50 percent, or the majority rule. (For example, if four groups mapped a use, at least two of the groups must agree that an area is dominant for it to be included.) If a certain group did not map a certain use or had incomplete knowledge over the whole study area, this input can be excluded from the minimum threshold value and should be reflected in the metadata.

Phase 5: Data Validation and Publication

Overview

In the final phase of the mapping project, draft data are reviewed and validated by workshop participants to prepare for final product distribution. This includes outreach to project participants for draft data feedback, consideration of comments and refinement of draft data, and final data product development, publication, and distribution.

Checklist

- Contact workshop participants to review the draft data
- Finalize the data based on participant feedback
- Distribute data products according to partner agreement

Data Validation

Once the data have been processed, draft maps should be created for all uses and should include any contextual information derived from the use questionnaires and staff notes. The draft maps can be used for internal review and can assist in data validation. Draft maps can be generated as digital files, hard-copy map booklets, or electronic GIS files.

Data validation is an important step in finalizing ocean use data. It can increase confidence in the final products by allowing additional users to comment on the draft maps and to provide context to the mapped use patterns. In some cases, users who were unable to attend the workshops can be allowed to offer their insights, which can then be incorporated into final products. This process may take several forms, depending on the means available to the workshop organizers. Multiple validations can be used, but be aware that data revisions may be necessary, and plan for adequate time to incorporate the feedback into final maps.

Consider whether public presentations, focus group discussions, or individual interviews would be the preferred target for data validation. Each option has potential benefits and drawbacks in terms of the dynamics of the discussion and the types of feedback that will be provided. This decision may also depend on the transparency requirements of the project, which may require more public involvement throughout the process.

The decision on how to validate the data will also require a method for displaying the data. Meetings can be held in person or virtually in a webinar format. Hard-copy map booklets can also be given to key individuals with a request to provide written feedback as notes on maps. In either case, the draft maps referred to above will be needed. Verbal feedback provided in group discussions must be noted, and the decision made whether comments should result in changes to the draft data. Specific revisions are at the discretion of the project leads according to information provided. In some cases, workshop facilitator notes can aid in these decisions. The final use metadata and project reports should reflect the revisions made during the data validation steps.

Final Packaging and Distribution

There are various ways to publish data and products, so before creating a deliverables package, it is important to consider the target audiences and their potential application of the products. To serve a variety of clients, it can be useful to provide the data and products in various forms through a common portal or website. In addition to any custom analytical products, a GIS data package, metadata, and a basic set of maps should be generated for distribution.

The project team should work with intended data users to decide on the preferred file formats. Geodatabase and shapefile formats are the most common for serving vector-based data. In either case, the data set should include fields (with aliases) for a grid cell ID and presence/absence fields for the general use footprint, dominant use areas, and future use, if mapped. Typically, presence or absence is denoted by 1 or 0, respectively, which allows for the creation of aggregate use data sets using the sum of individual use presences.

The use data can be stored in many ways, as individual data sets for each use or a single data set with all uses combined in one data table. While a single data set makes distribution as well as some analyses easier, consider having both versions available to simplify future analyses. Data sets can also be created that aggregate specific uses (e.g., all recreational uses). Base map data may also be useful to include as part of the GIS data package. In particular, users might have a need for the study area boundary, reference points, or other relevant spatial data used in the processing. But be aware of file sizes and any possible sharing constraints when packaging data for distribution.

Complete Federal Geographic Data Committee (FGDC) or International Standard Organization (ISO) metadata are a required component of the data package. By default, GIS software will enable the GIS analyst to write the metadata as a part of the GIS files, but a plain-text version of the GIS metadata can be helpful to include for any interested parties who may want project information without the need for GIS software. The metadata should include a description of the project and definitions of all uses mapped.

In addition to the digital spatial data, it is common to deliver a set of maps as part of the deliverables (Appendix 5-1). Maps can be created for each use individually, showing the footprint and dominant use areas, along with contextual information collected on the use questionnaires. Heat maps that visualize the overall intensity of use across the region or maps of uses aggregated by sector are some other cartographic options. When creating the map template, pay close attention to how the data are symbolized near the coastline, and choose symbol colors that display well to maximize the reader's ability to discern the use patterns.

Data distribution can be as simple as posting the GIS data package and maps on an appropriate website alongside other project reports and documentation. However, to reach the maximum audience, several distribution methods should be explored. Web services are a common way for non-GIS users to explore data and create maps without access to desktop GIS software. If web services are created, it is necessary to consider the long-term commitment for their maintenance and refinement over time as users request modified services for various unique applications. With additional technical and budgetary resources, another option is the creation of customized mapping applications that enable end-users to more fully explore the ocean use data through a web browser. While both services and mapping applications may increase the overall visibility of the data products, it is important to consider the costs and benefits to either approach and specifically as they apply to the project's client base.

Summary

Understanding ocean use patterns can improve decision-making and planning in the marine environment by contributing vital foundational information. Engaging communities that use the ocean to provide this important foundational information has the added value of linking people to the planning process and building confidence in the results. The participatory mapping method described throughout this guidebook offers a proven approach for practitioners who are looking to make more informed decisions for the marine environment and the communities that depend on healthy marine ecosystems.

In planning a PGIS process, remember that the guidelines set forth in this document are just suggestions and that each process needs to be flexible and molded to best meet local needs. Keep in mind that the power of the process comes through building relationships with the target use community and learning about the history of planning and the hot-button issues that affect the daily lives of workshop participants. Remember that collecting data is one thing, and connecting with people and earning their trust is something entirely different. To successfully capture the data, make time to listen to participants' perspectives, frustrations, and concerns, and encourage dialogue about often tricky and sensitive topics. Be honest, genuine, and transparent when messaging about the project, and prepare staff members with skills to facilitate communication on often contentious topics and with challenging personalities.

Remember that the communities participating in the workshops will continue on after the project ends. Consider what you are contributing to these participants and how the process can best serve them into the future. Always deliver on what you promise your partners and participants, and deliver it when you promise it.

Lastly, it is important to remember that every place is unique. Lessons learned in one locale, while they can indeed inform the process in another, should be modified to address the unique characteristics of the target community.

For more information, please visit www.marinecadastre.gov/oceanuses.



NOAA Office for Coastal Management

2234 South Hobson Avenue

Charleston, SC 29405-2413

www.coast.noaa.gov

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