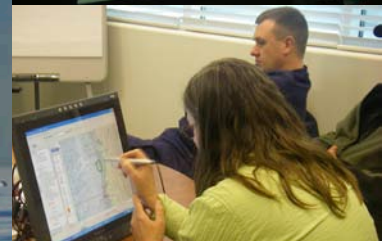


# MAPPING

## HUMAN USES OF THE OCEAN

Informing Marine Spatial Planning Through Participatory GIS



November 2010

# Introduction

Understanding human uses of the ocean is an essential component to successful marine resource planning and management. Unfortunately, spatial data on ocean uses are limited, as use patterns are often qualitative, subjective and difficult to capture consistently over large areas. Further confounding this problem, knowledge of ocean use patterns is often held by a small number of individuals within each sector who routinely observe the coastal and marine environment and the activities occurring there. Emerging technologies in the arena of participatory Geographic Information Systems (GIS) are providing new ways to tap this critical knowledge and document human use patterns in a spatial context. Participatory GIS techniques offer a unique, interactive means of collecting spatial information on ocean uses that capitalizes on expert knowledge from local individuals through the application of specialized GIS mapping tools.

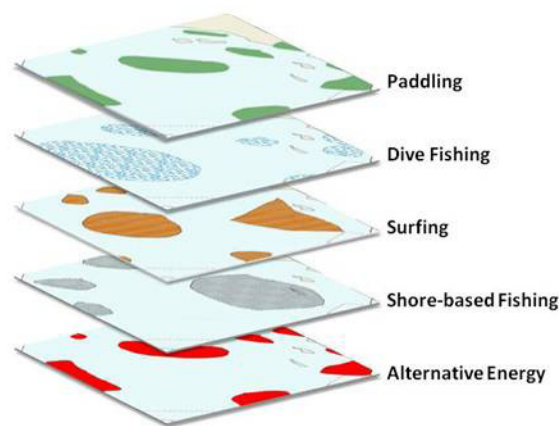
For the past two years, NOAA's Marine Protected Areas Center (MPA Center) has been engaged in various participatory mapping efforts to document

human uses of the coastal and marine environment throughout the U.S. Through a refined participatory process, the MPA Center has successfully mapped nearly 30 distinct uses of the ocean at multiple scales, across different domains and for a variety of marine management applications. This document summarizes our mapping approach, explains the main steps and identifies key lessons learned throughout the process

and tips for designing and implementing a successful participatory GIS project for related applications.

Completed in partnership with the Marine Conservation Biology Institute (MCBI), the California Ocean Uses Atlas project gathered human use data for non-consumptive uses, fishing activities, as well as industrial and military uses from the shoreline to the 200

nm offshore boundary of the Exclusive Economic Zone. Valuable insights have been gained through the completion of this statewide, large domain mapping project and have been useful in subsequent mapping efforts in New England and along the Northwest coast of Hawaii. More information on the California Ocean Uses Atlas and related products can be found online at [www.mpa.gov/atlas](http://www.mpa.gov/atlas).



# The Participatory GIS Approach

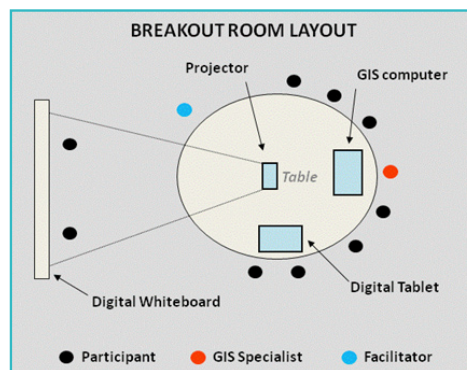
In the MPA Center's participatory GIS process, spatial data on ocean uses are gathered through a series of participatory GIS workshops that engage local and regional ocean experts to map ocean use areas in a live, interactive mapping environment. Prior to the workshops, regional research is conducted to profile the types and categories of uses that occur in the study area and to explicitly define the targeted uses or activities to be mapped. Meetings with resource managers, local regulatory agencies and stakeholders are also conducted to refine the scope of the mapping effort, consult on appropriate mapping scales and prioritize the uses that are most relevant to the region and current marine management issues. This also provides an opportunity for initial outreach to gain support and interest in the mapping effort and to ensure that the resulting data will best serve management needs.

Once the initial outreach and regional profile is completed, workshop participants are identified based on their knowledge and experience working or living in and around the coastal and marine environment, and their ability to speak knowledgeably on behalf of the targeted uses.

Multiple individuals for each use category are invited to attend the workshops in order to capture various use perspectives, ensure data completeness and accuracy and to allow for data redundancy. In the workshops, participants are briefed on the project objectives, introduced to the mapping technology, then split into breakout groups (based on their use knowledge) and tasked with mapping a suite of ocean uses as a team.

In each breakout group, a group facilitator and GIS specialist lead the participants through the mapping

process, record notes on group discussions and provide technical support. GIS base maps of the study region are projected onto a digital whiteboard and tablet and participants are asked to draw use areas directly onto the projected maps. All participants are given the opportunity to draw use areas and after each use is mapped, the participants have the opportunity to view their mapped results and to refine 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. It is also helpful to create a decision tree or processing protocol to ensure consistency when editing and processing the use data. Once processed, the GIS data, metadata, maps and related analytical products are then compiled and published online. The final stage of the mapping effort involves outreach to the participants, and potential clients or data users. This is achieved through webinars, conference presentations and onsite meetings with select resource managers.

This is an abbreviated summary of the participatory process that the MPA Center designed to gather ocean use data. It is intended to be a flexible and mobile approach that can be refined and adapted for any region or domain and to address multi-scaled management decisions. Below is a more detailed description of the main steps in the process and the lessons learned throughout the MPA Center's ocean uses mapping experience.

# Step-by-Step Lessons Learned

## PROJECT PLANNING

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The first stage of the planning process should be the definition or refinement of the project scope, including the delineation of the study boundaries, identification and prioritization of the use categories, and consultation with key user groups, stakeholders and resource managers. If working in collaboration with partners, this is a good time to decide on roles and responsibilities and to designate points of contact for workshop planning and logistics. Once funding and logistics are ironed out, this initial scoping phase will inform the scale of mapping needed to address local issues, the sorts of uses that are occurring or presenting local or regional management challenges, and the potential data users or clients. This also promotes support and interest in the project, its outcomes and intended applications and helps to source an initial list of potential workshop participants.

Ideally, the planning process should begin months in advance of the workshops to ensure that key participants will be able to attend, facilities and accommodations will be available and project staff has sufficient time to prepare. Depending on the number of workshops and participants involved, as well as the preparation workload, six months prior to the workshop date is a good rule for instigating the planning process. When resources allow, it is advisable to have a designated project coordinator to handle the planning process, manage outreach and deliver a consistent message about the project and its intended objectives and applications.

- ✓ Define project scope and study area boundaries
- ✓ Consult with key stakeholders, managers and clients
- ✓ Identify and define important uses and use categories
- ✓ Create initial list of potential workshop participants

## PARTICIPANT IDENTIFICATION

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The success of the participatory process is intimately linked to 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. 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. As the referrals are received, begin to consider timing of workshops, venues and potential lodging options, if needed.

Based on 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.

- ✓ Lifeguards
- ✓ Park Managers
- ✓ Harbor Masters
- ✓ Local Fishermen
- ✓ Fish & Game Wardens
- ✓ Federal Agency Officials
- ✓ Scientists & Researchers
- ✓ Military Representatives
- ✓ Law Enforcement Agents
- ✓ Marine Business Operators
- ✓ Local NGO Representatives
- ✓ Tribal Council Representatives

The following months involve tracking responses, building the participant database (which lists confirmed participants, use and geographic expertise, contact info and communication tracking) and following up with ongoing referrals. This phase continues until there are enough confirmed participants for all targeted use categories.

- ✓ Outreach to initial participant list for referrals
- ✓ Plan workshop logistics, including location, lodging and staff roles
- ✓ Build participant database and track attendance confirmations

When the confirmed list is near complete, the database is used to divide participants into breakout groups based on use and geographic expertise in order for all groups to have equal representation of use knowledge across the study area. It is important to note that no-shows on the day of the workshop can throw off the group balance, so this is something to try to avoid when possible.

**TIPS:**

- Provide official invitations at least two months in advance to secure participants availability
- Follow up referral and invitation emails with a phone call
- Call all confirmed participants one week in advance to check in and remind them of logistics

## GIS PREPARATION FOR WORKSHOPS

The workshops are the crux of the entire mapping process and their success relies heavily upon advance 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. Once the project scope is defined, the GIS staff can begin compilation of digital mapping resources, base maps, paper maps and related cartographic products to assist in the mapping workshops.

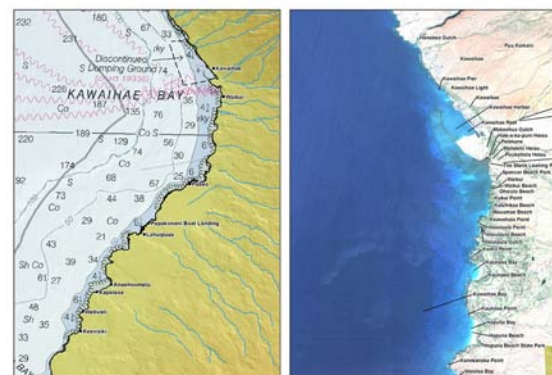
Workshop participants will use various sorts of geographic points of reference to locate themselves spatially on a map, so it is important to build base maps that provide as many reference layers as reasonable to meet diverse needs (e.g. fisherman tend to prefer nautical charts versus hill-shaded bathymetry, 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 at the designated mapping scale (e.g. ports and harbors, buoys, coastal access points, submarine features, cities and towns, named beaches, parks and MPAs). Additionally, it is always useful to have high resolution aerial imagery of the shoreline, as well as digital raster graphics (DRGs) or topographic grids of the terrestrial coastal environment to provide additional spatial reference.

Compiling the digital base map layers can be tricky, as there are lots of existing data layers that might seem useful to the mapping exercise, but that are either incomplete for the study area, at a poor resolution or not from an authoritative source. Choose base layers wisely; more is not always better. In our experience, more time can be spent discussing the inaccuracies of existing data than the intended mapping of the uses, so try to avoid using base data that is old, incomplete or non-authoritative.

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.

- ✓ Acquire geographic base layers and compile digital base map
- ✓ Create and print large format wall maps and table maps for reference
- ✓ Prepare and test technology, including hardware, software & peripherals

The technology must also be prepared and verified to test the software and peripherals and to verify 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 (projector, digital table and whiteboard technology), and extra cables, batteries and projector bulbs should be included in the workshop hardware kit. An entire set of hardware should also be available as an alternate or back-up in case any part of the system should fail in a breakout group.



Sample Basemap Data Layers

## WORKSHOPS



Timing is everything. For the workshops to be successful, participants need to have sufficient time to map all the targeted uses, so it is very important to keep on schedule and prevent lags in the mapping process. However, mapping requires constant concentration and participation, so it is also important to have multiple breaks, provide snacks and refreshments and allow some time for people to connect and network with each other.

Participants receive a folder upon arrival that includes a nametag (color coded by breakout group), a workshop agenda, a list of uses and use definitions, detailed instructions on the mapping process, venue logistics, and evaluation forms. Participants convene with workshop staff to be briefed on the project, the mapping process and the venue logistics before dividing out into breakout groups. Staff is also provided a folder, explaining defined roles and responsibilities, as well as detailed instructions for their designated tasks.

Each breakout group is paired with a group facilitator and GIS specialist who work to keep the group on task. Participants are oriented to the tools and the use definitions, and then asked to draw areas on the map where each defined use occurs. This step can also capture spatial variations of the use, such as seasonal, temporal, or socio-economic (value/importance/intensity) patterns, depending on the intended applications. Note however, that capturing variations of use patterns will limit the total number of uses that can mapped during the breakout sessions.

- ✓ Introduce the mapping objectives, technology and workflow
- ✓ Separate participants into breakout groups based on use knowledge
- ✓ Facilitate mapping through discussion and use of applied tools
- ✓ Record disputes, qualitative comments and notable discussion topics

Participants begin by drawing use areas on the whiteboard or the digital tablet. The facilitator reminds the group of the exact definition of the use and the designated mapping scale and encourages the group to document the use pattern across the study area using the interactive tools. As more areas are drawn and the pattern begins to emerge, the group is asked to refine and finalize the use layer. When confident with the use patterns as drawn, the data are saved and the group moves on to the next use. Workshop staff record notes throughout the process to capture other non-spatial information about use patterns that may be relevant but not recorded on the map. This workflow continues throughout the rest of the workshop with intermittent breaks until all the uses are completed.

## DATA PROCESSING

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Depending on the number of breakout groups, participants and uses, the data compilation and processing workload can vary significantly. Building GIS models can assist in processing the data, but an initial manual review of use files is required to verify data consistency, integrity and completeness. Notes maintained throughout the breakout session are very useful for this initial review, as they can help explain any irregularities or tag potentially suspect areas.

- ✓ Compile, review and process use data for intended applications
- ✓ Design and adhere to processing workflow to maintain data integrity
- ✓ Create a set of processing rules to assist in editing
- ✓ Consult workshop notes for data clarification

Many processing decisions are related to the number of breakout groups and amount of data redundancy built into the mapping process. However, it is helpful to set up processing rules to keep track of standard protocols specific to a certain use of set of uses (e.g. clipping out land areas, erasing beyond a certain referenced depth contour). These rules and protocols should also be explicitly documented in the project metadata to provide a clear description of the workflow, editing steps and data compilation.

## MAPS AND CARTOGRAPHIC PRODUCTS

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The products generated from the use data should support a variety of clients' and users' needs, both in content and format. Depending on the intended application of the data, the products can range from paper maps and map books, to online digital GIS data, to interactive data exploration tools. Outreach to resource managers, data consumers and other clients can help define the product needs, but think broadly to ensure that the data is accessible, interpretable and applicable to a diverse audience.

**TIPS:**

- Provide products in both digital and hard copy format
- Create synthesis layers or case study examples as sample data applications
- Build online data viewers or simple web-based tools to explore the data
- Outreach to data users to define product needs for intended applications





## RESOURCES

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Resources needed for human use mapping will vary depending on the capabilities of partners, the size of the area to be mapped, and the number of workshops required. Standard expenses to consider when planning workshop budgets may include the workshop venue, event catering, participant travel, workshop equipment and staff time and travel. The following rules of thumb may also be useful:

### **Workshop Organization:**

- Number of breakout groups should be decided based on the scope of uses to be mapped and the staffing resources
- Uses can be grouped into categories to focus specific workshop days or breakout groups on selected uses or use categories (e.g. consumptive, non-consumptive, military/industrial)
- Breakout groups should be designed to include participants with a range of expertise that covers all the uses to be mapped

### **Breakout Groups:**

- Number of participants (excluding staff) should be limited to 5-10 people
- Staff should include one designated GIS specialist and one process facilitator per group
- List of uses to be mapped should be ordered to prioritize uses for which there is expert knowledge within the group and to ensure data redundancy across breakout groups

### **Equipment for each Breakout Group:**

- Digital whiteboard technology (EBeam or SMART board)
- Digital tablet (Symposium or similar interactive pen display)
- Laptop with GIS software (ArcGIS v10.0 or ArcGIS v9.x with ArcSketch)
- Digital Projector

# Summary

Participatory GIS practices are rapidly evolving to meet the needs of coastal and marine spatial planning efforts at local, state and regional scales. Engaging experts and stakeholders in the delineation of use patterns and providing a context to gather and refine spatial data, the participatory GIS approach helps to bring often inaccessible expertise and knowledge into the spatial arena and yields critical information to support resource planning and decision-making. When planning participatory GIS projects, attention to hindsight gained from previous mapping efforts can be helpful in avoiding potential pitfalls and in ensuring that the data outcome meets the project objectives.

For more information on the participatory approach used by NOAA's MPA Center or to access spatial data, analyses and maps derived from previous human use mapping efforts, please visit [www.mpa.gov/atlas](http://www.mpa.gov/atlas).



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