Geospatial Decision Support Tools for Planning of Marine Protected Areas in California

WILL MCCLINTOCK (UNIVERSITY OF CALIFORNIA SANTA BARBARA), **MATT MERRIFIELD** (THE NATURE CONSERVANCY), **SOPHIE DE BEUKELAER** (NATIONAL MPA CENTER), **PAULO SERPA** (CALIFORNIA DEPARTMENT OF FISH AND GAME), **MARY GLEASON** (THE NATURE CONSERVANCY)

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MARINE GEOMORPHOLOGY AS A DETERMINANT FOR ESSENTIAL LIFE HABITAT II: AN ECOSYSTEM MANAGEMENT APPROACH TO PLANNING FOR MARINE RESERVE NETWORKS

Outline

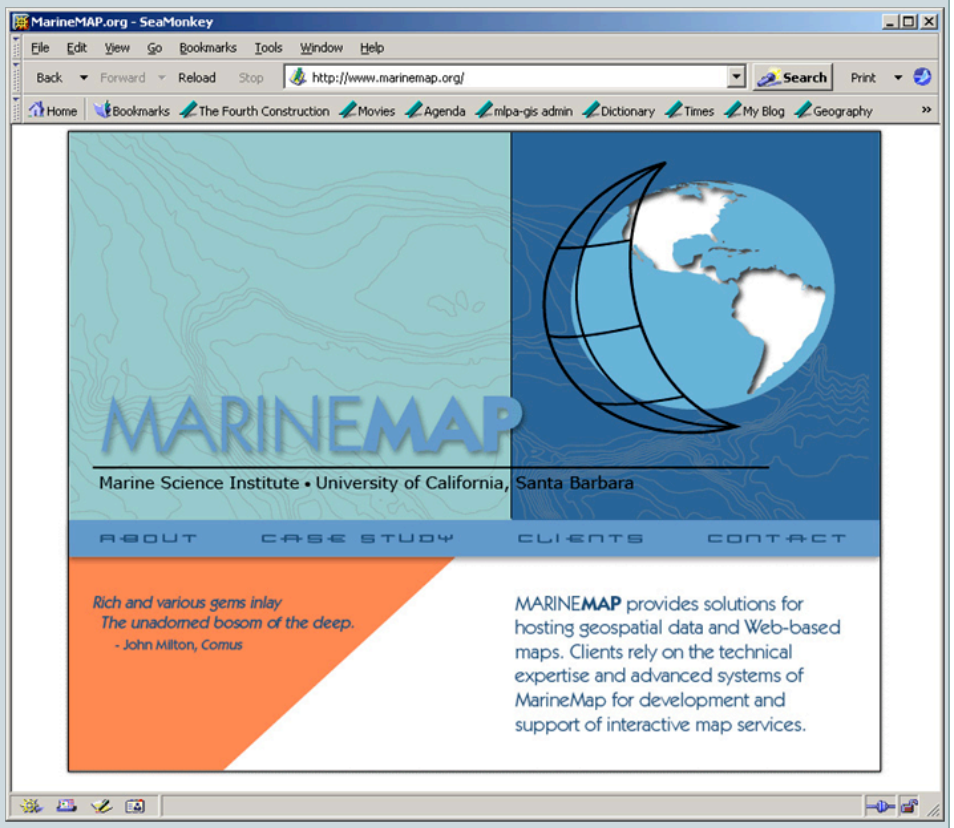
- California Marine Life Protection Act (MLPA) Initiative
  - Task at hand
  - Stakeholders, Science Advisory Team, Blue Ribbon Task Force
- Current Decision Support System
  - Geospatial Database
  - Internet Map Services
  - Doris (MPA Decision Support Tool)
  - Desktop GIS tools
- Future Directions
  - Open Source Database and Mapping Tools
  - Discussion Forums
  - Global Geography

California Marine Life Protection Act Initiative

- Marine Life Protection Act (1999)
  - Mandates establishment of a managed network of MPAs to:
    - Protect marine life, habitat, ecosystems and natural heritage.
    - Improve recreational, educational and study opportunities provided by marine ecosystems.
  - Must use best, readily available science to guide decisions.
- MLPA Initiative – a Public-Private Partnership (2003)
  - Initiative Staff
  - Stakeholders (Commercial & Recreational Fishers, Scientists, Teachers, Conservationists, Artists, Policy Makers, etc.)
  - Science Advisory Team (Appointed by Dept. of Fish and Game)
  - Blue Ribbon Task Force (Appointed by the Governator)

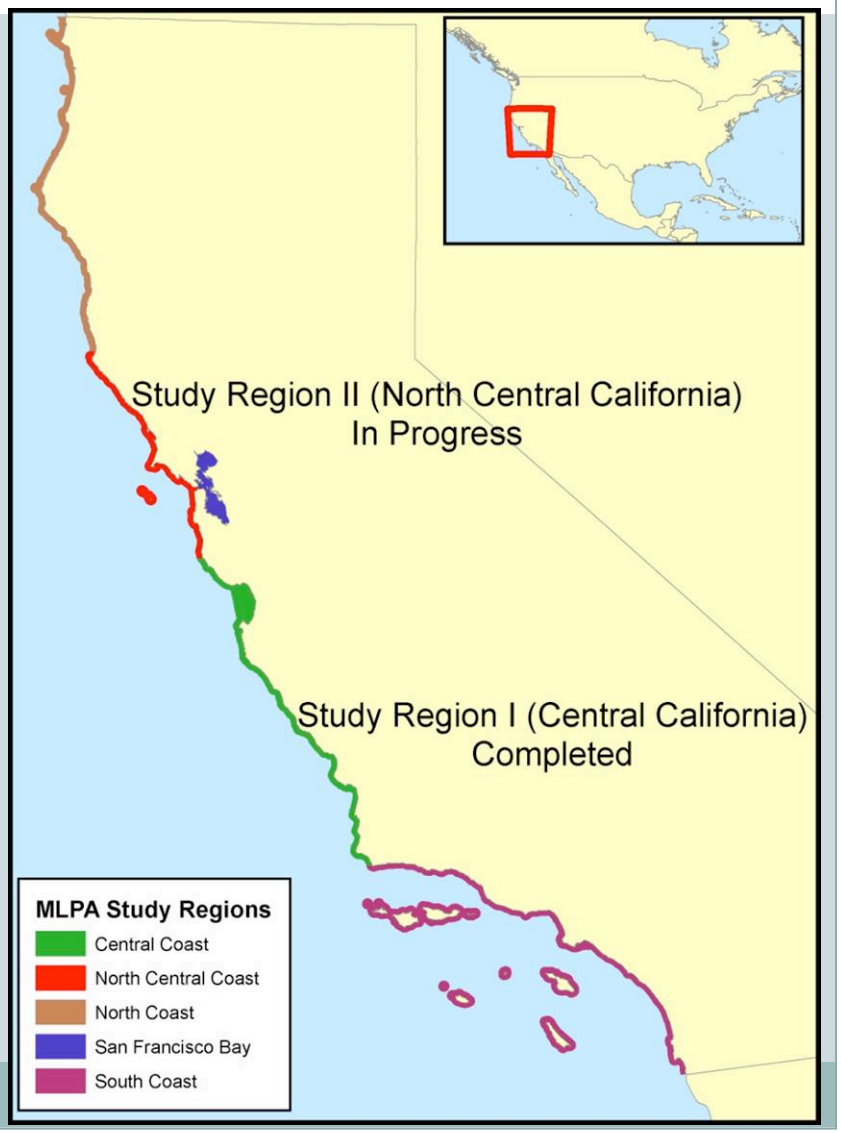
MarineMap.org

- Consortium of scientists and technologists
  - TNC
  - Ecotrust
  - UCSB
  - NOAA
- Contracted by Initiative to develop and host decision support system

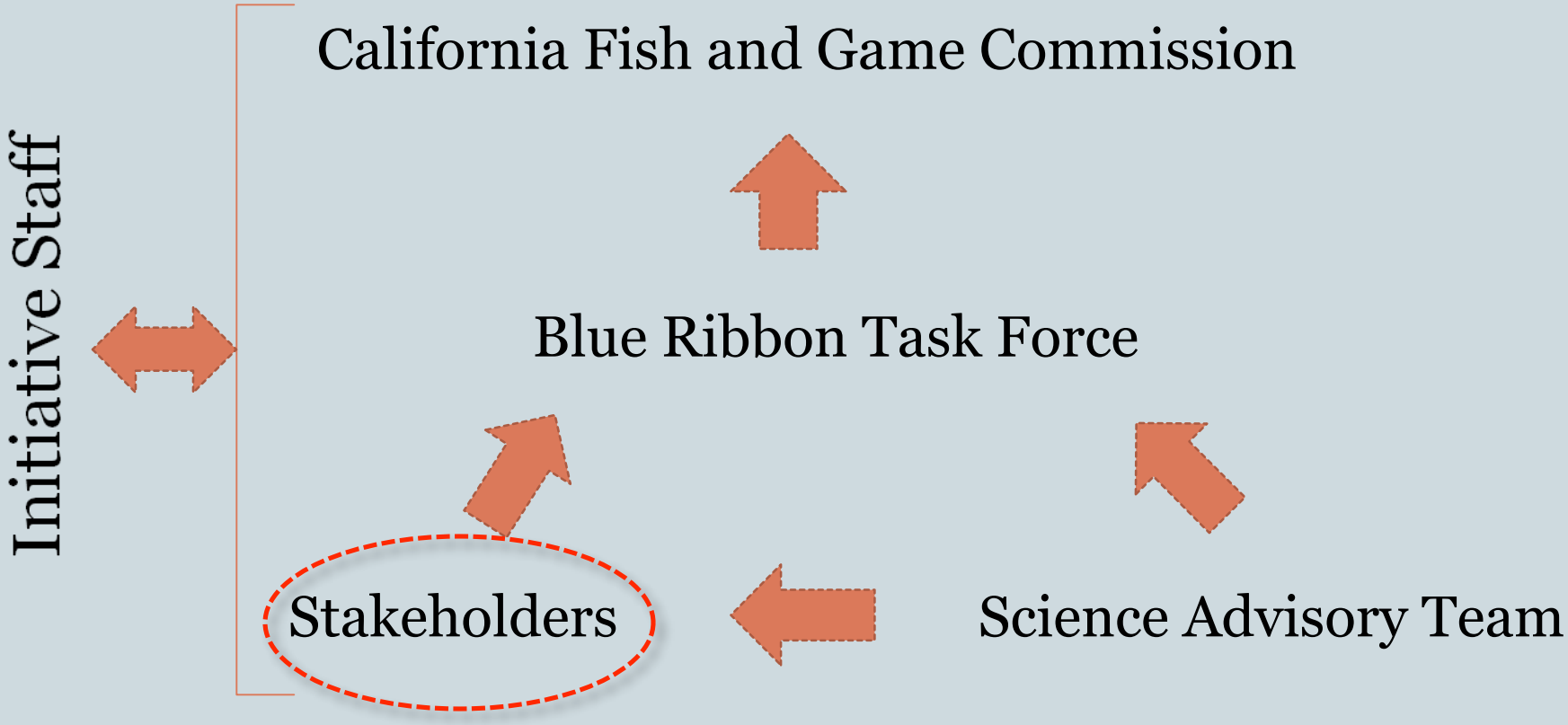


MLPA Initiative Study Regions

- To be completed by 2011
  - Progressively working through six regional study areas that divide the California State waters.
  - Completed Phase I (29 new MPAs established for Central California in August, 2007)
  - Currently in Phase II (the North Central Coast Subregion)



MLPA Initiative Structure

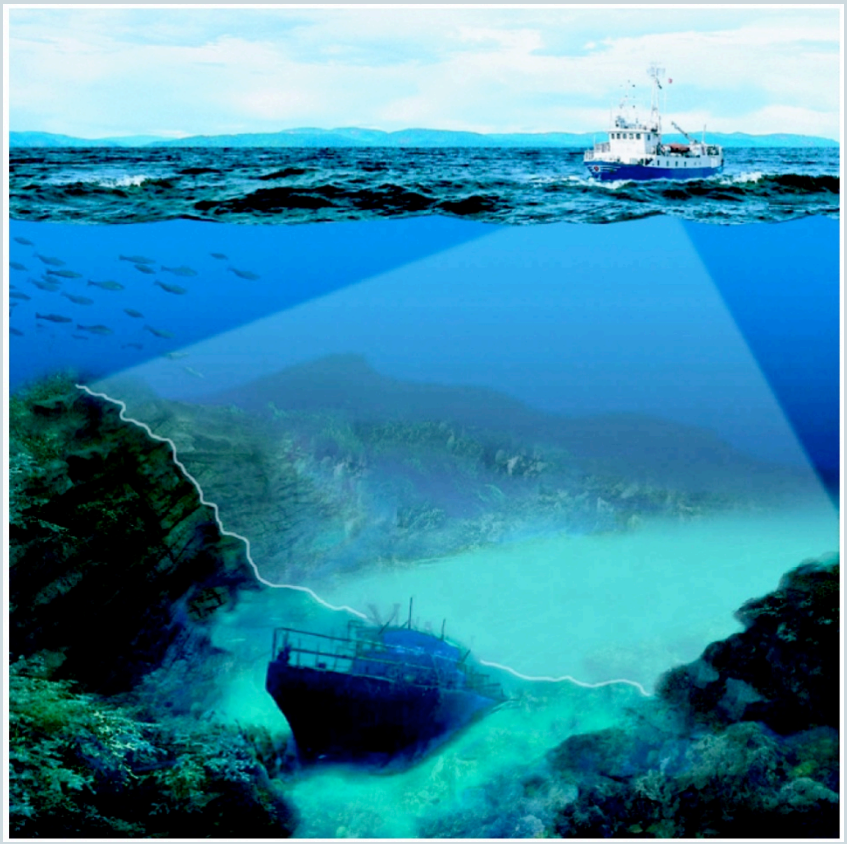


Geospatial Information Used in Process

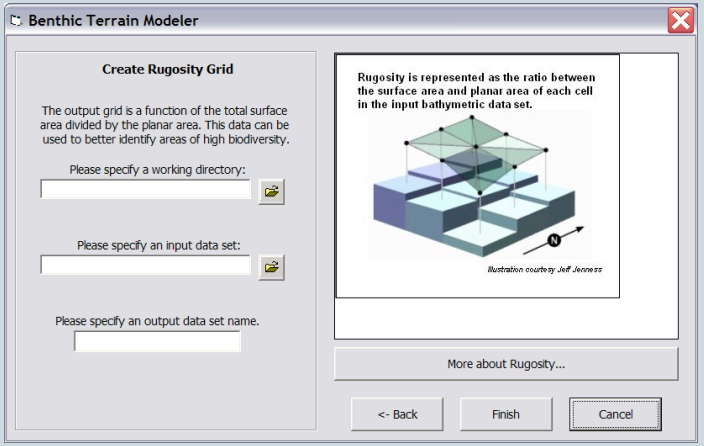
- Habitat
  - Distribution of kelp, seagrass, substrate types, bathymetry.
- Biological
  - Distribution of fish, birds, mammals, invertebrates, corals.
- Physical
  - Sea surface temperatures, upwelling, salinity, currents, impaired water bodies
- Cultural
  - Distribution of ports, coastal access points, cities
- Socioeconomic Data
  - Consumptive and non-consumptive activities (e.g., commercial and recreational fishing, recreational boating, diving, educational
- Base (reference) Layers
  - Existing MPAs, Study Area, Graticules, Nautical Charts

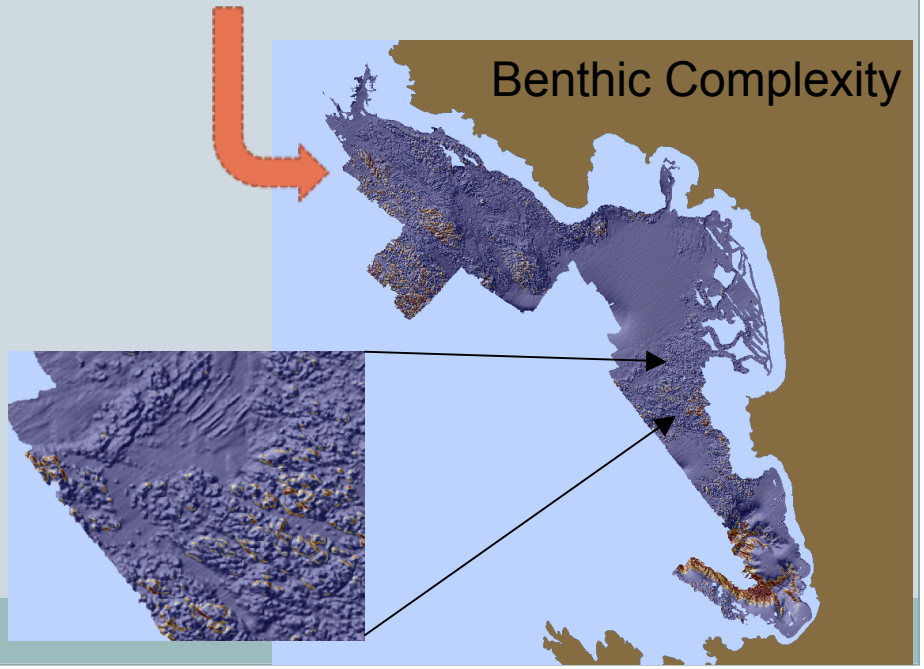
Key Data: Benthic Habitat

Side-scan / multi-beam mapping



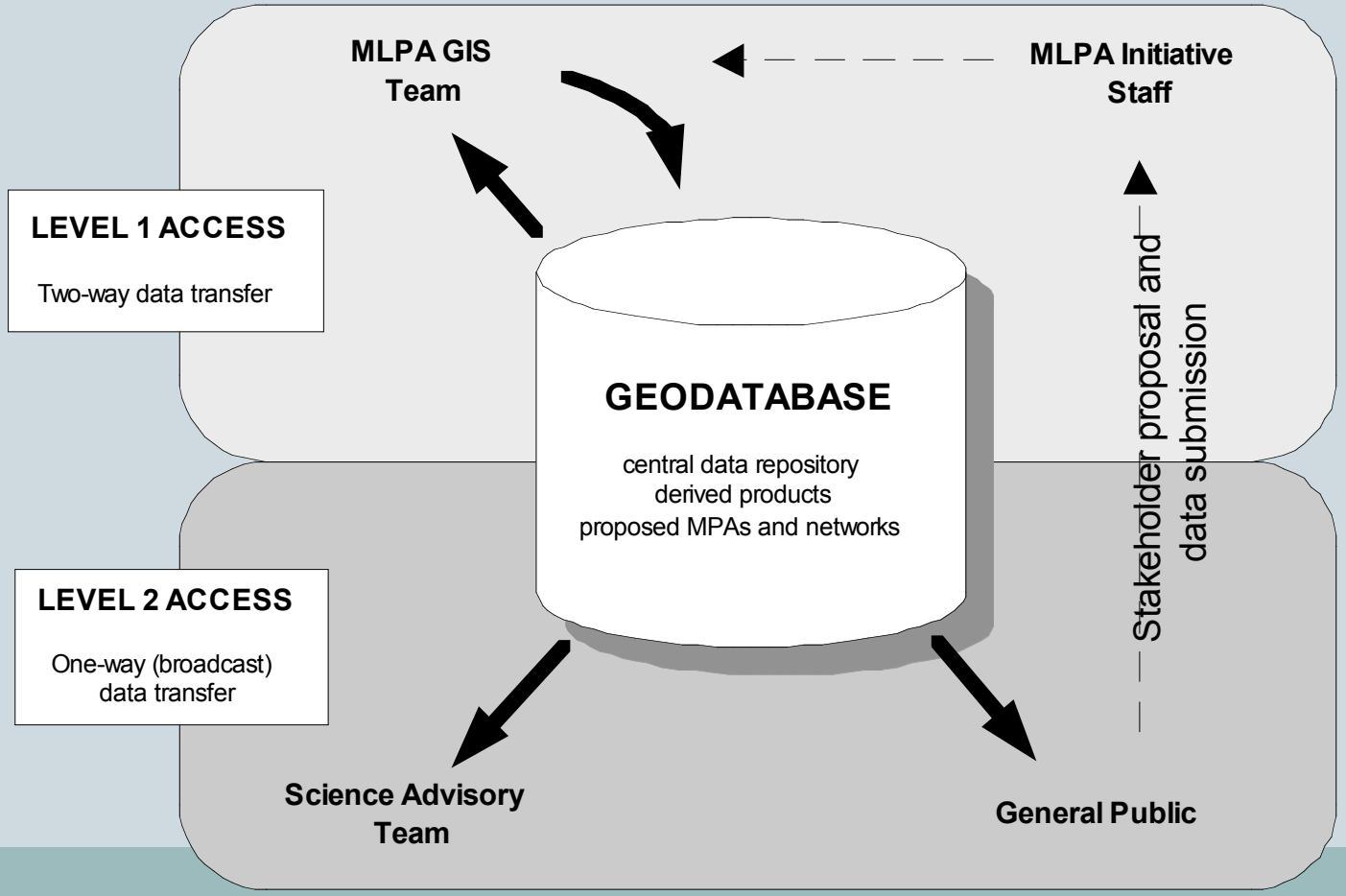
Source: NAP 2003. A Geospatial Framework for the Coastal Zone
National Needs for Coastal Mapping and Charting





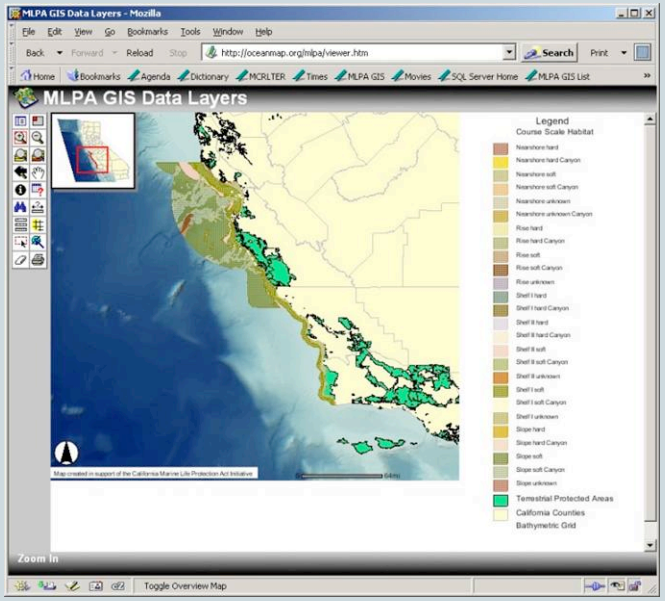
The Geospatial Database

Software Environment: ArcSDE and Microsoft SQL Server

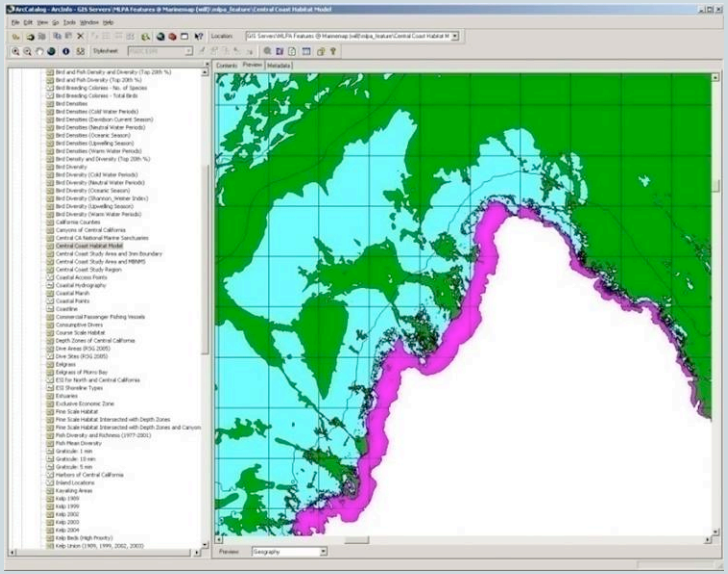


Distributing and Displaying Data

Software Environment: ArcIMS



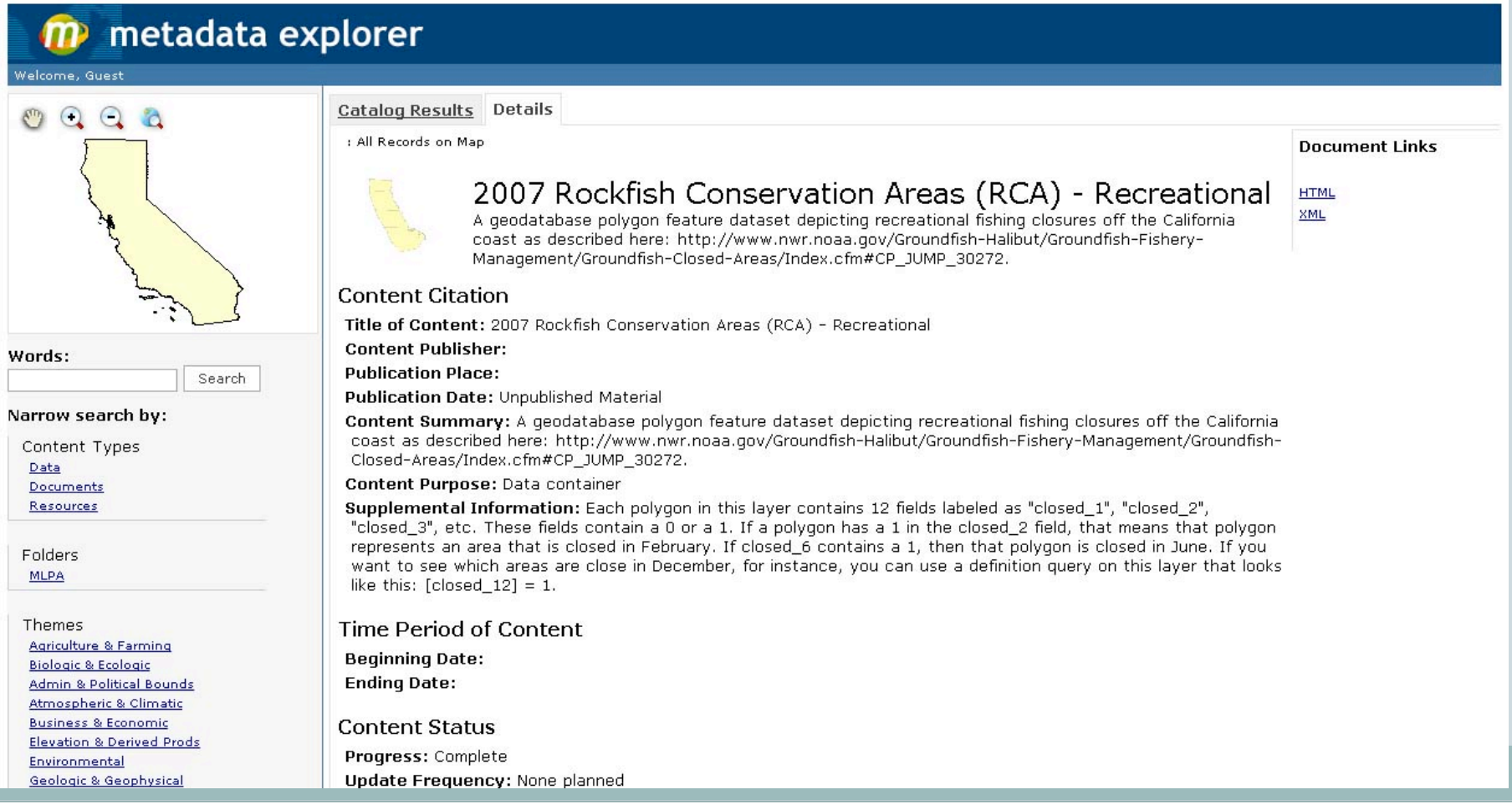
Viewing ArcIMS web-map in standard web browser http://marinemap.org/mlpaims



Connecting to ArcIMS Feature Service in ArcCatalog and ArcMap

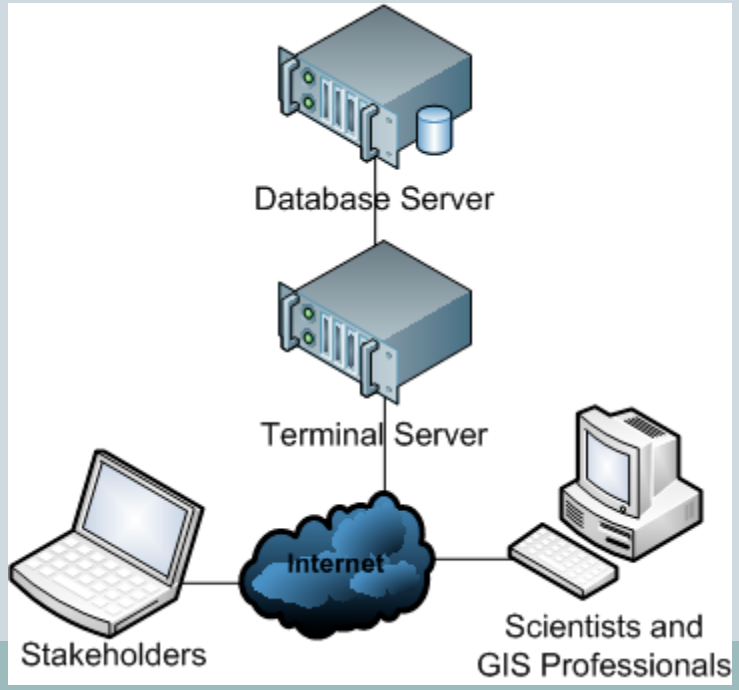
Metadata Services

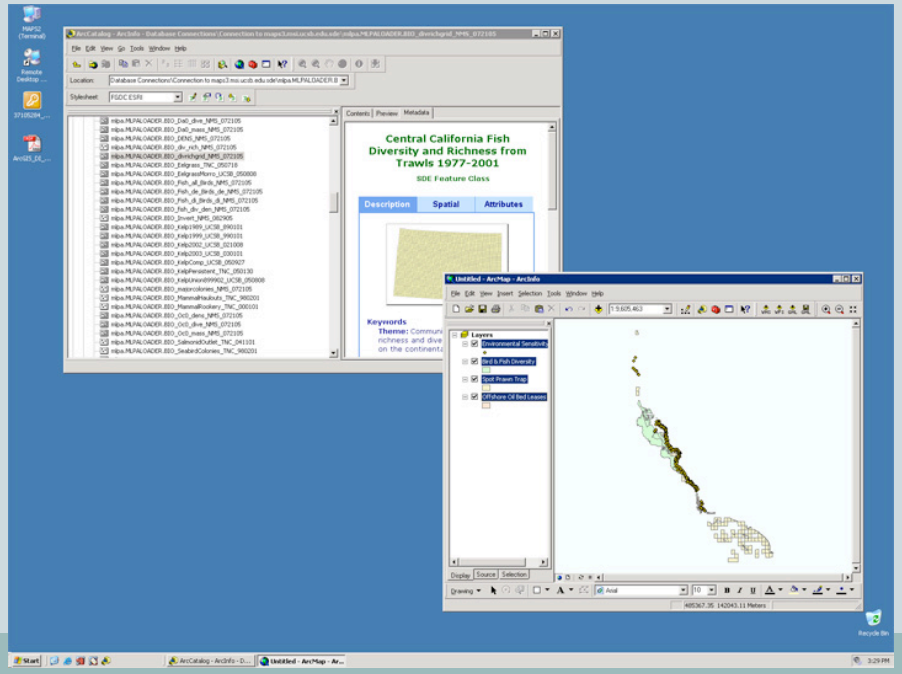
Complete metadata are online



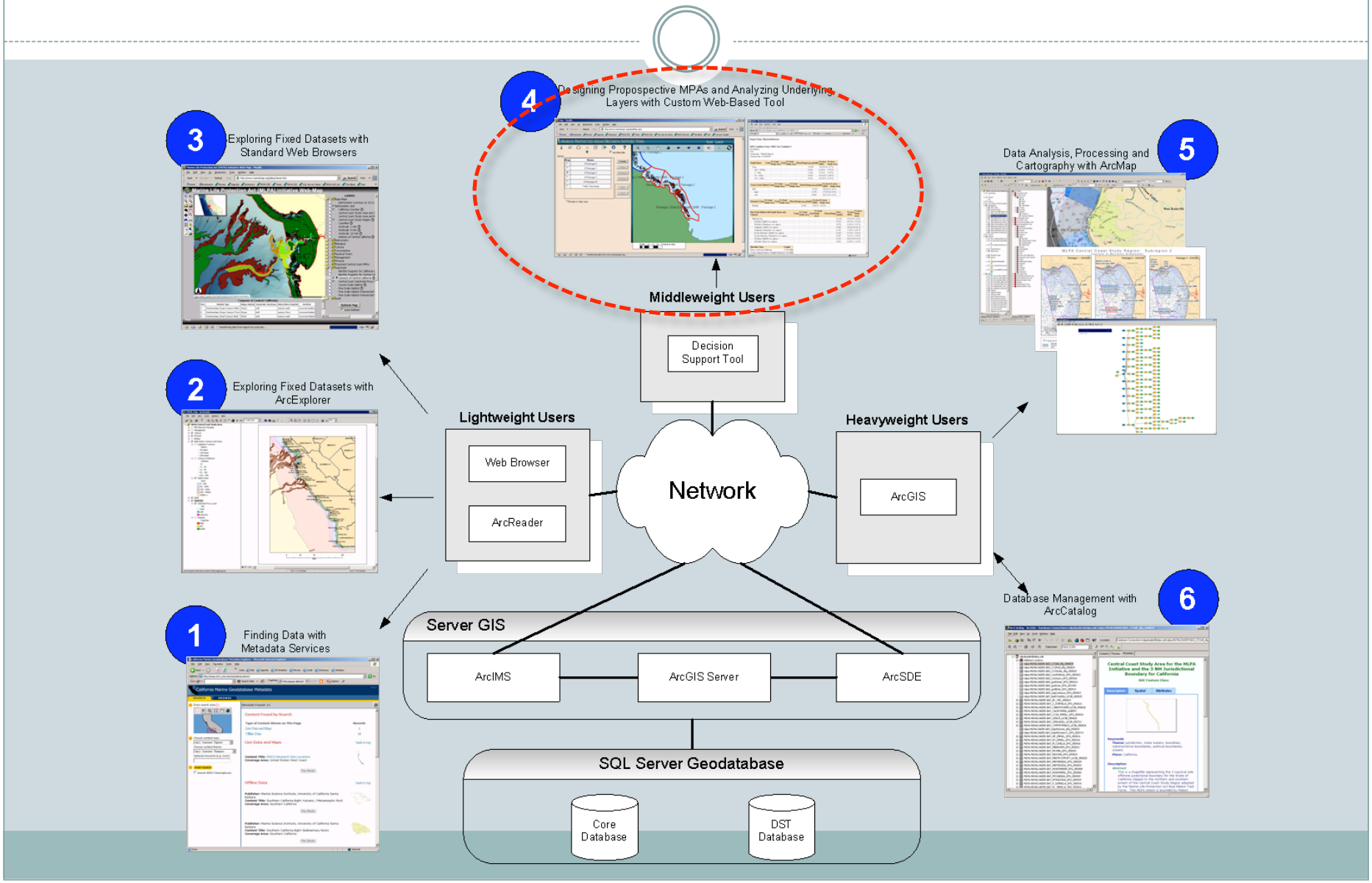
Solutions for the GIS Savvy

- Distribute entire database as “file geodatabase”
  - 8 gigabytes total
- Provide access to a terminal server with direct access to central ArcSDE geodatabase.





How it all fits together



Doris: MPA Decision Support Tool

- Accessed using a standard web browser.
- Designed specifically for stakeholders to:
  - Draw prospective MPA boundaries
  - Calculate what they captured inside prospective MPAs
  - Share prospective MPAs with other users
- Based on ArcGIS Server 9.1 technology.

(Doris is a sea nymph)

Doris: MPA Decision Support Tool

Password Protected (Private) Accounts for Stakeholders

Doris: Instructions Page

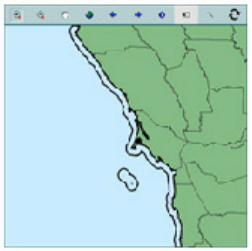
Doris MARINE PROTECTED AREAS DECISION SUPPORT TOOL

Instructions

log-out | help | Get Started

Step 1: Choose a Study Area

Select a study area. This will default the map to the area of interest.

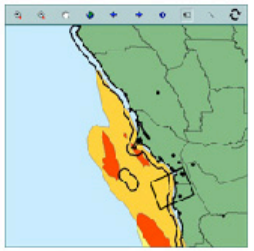


Step 2: Add Map Layers

Add the map layers that you are interested in capturing in a candidate Marine Protected Area (MPA).

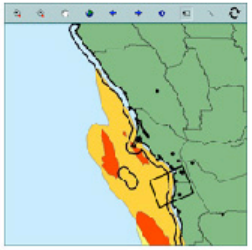
Step 3: Draw MPA

Draw a new MPA or add existing candidate MPAs.



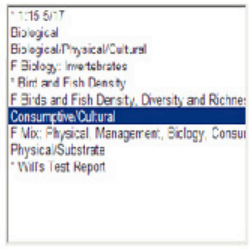
Step 4: Create a sytem or array of MPAs

Create and name a new system of MPAs. Add new MPAs or existing MPAs to an array.



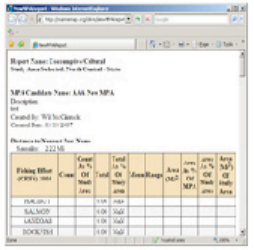
Step 5: Create or Load a Report

Select from existing reports or create a report based on layers that you selected.

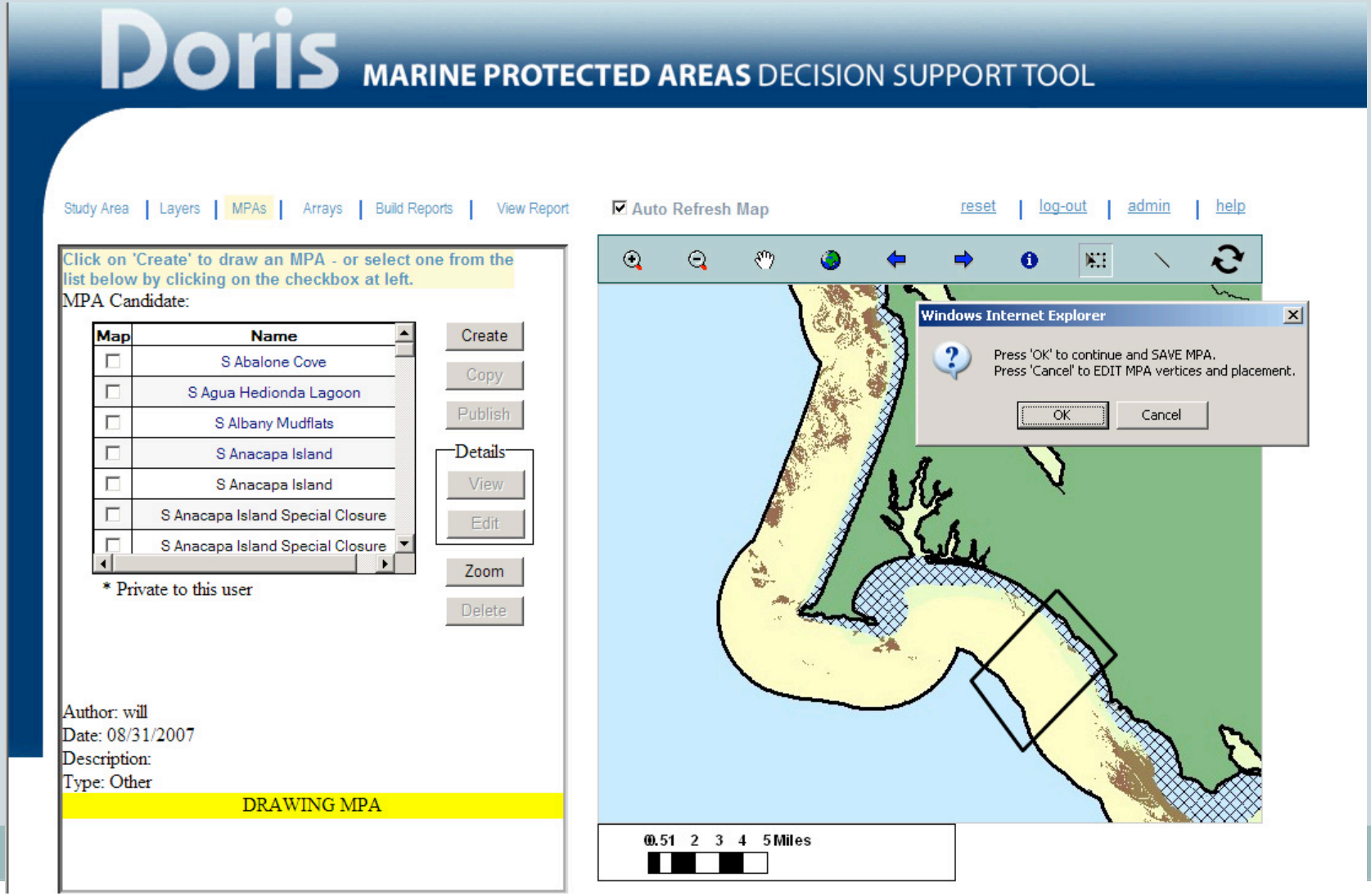


Step 6: View Reports

View statistics and compare percentages to determine if candidate MPA(s) provided the desired outcome.

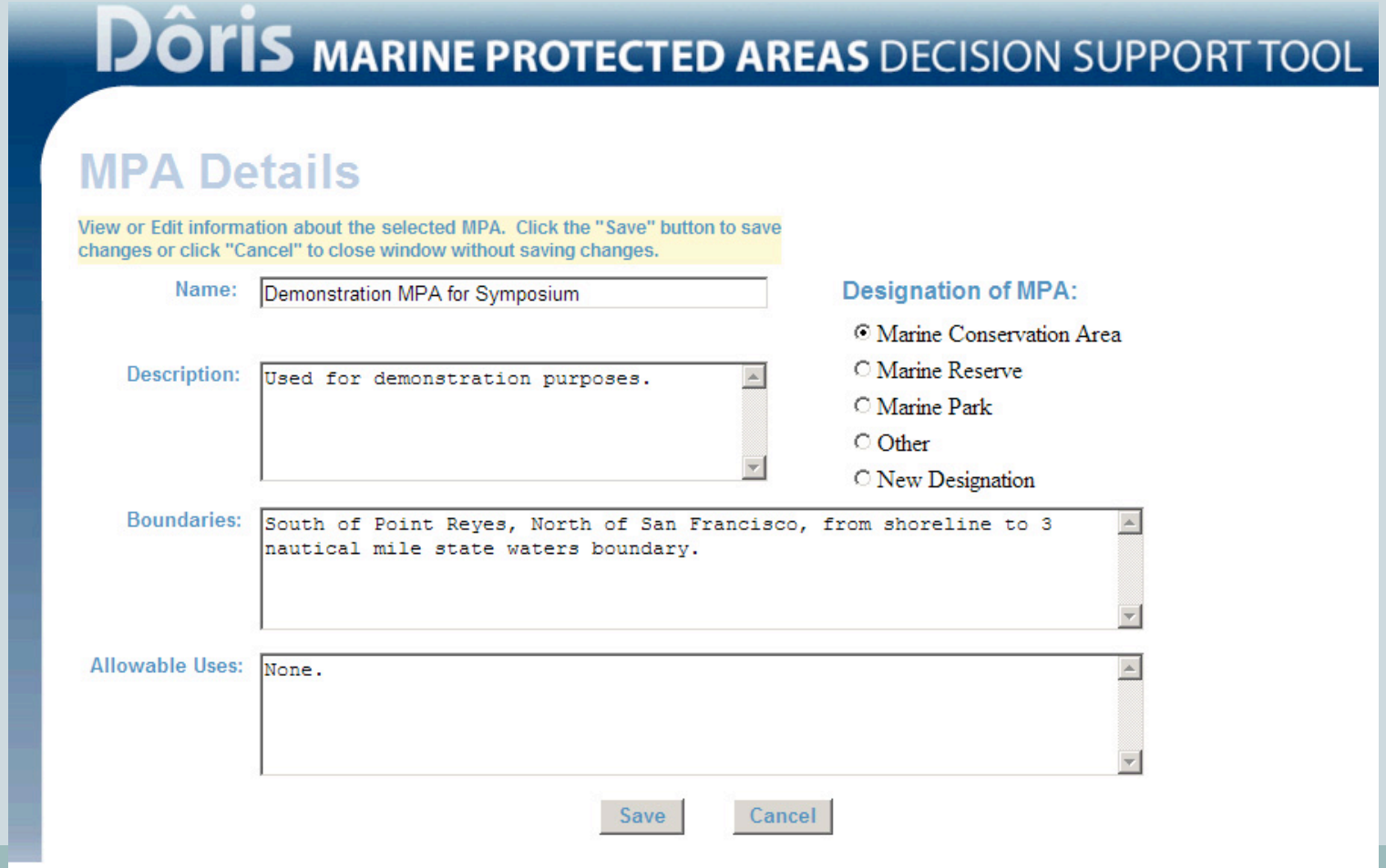


Doris: Drawing Prospective MPA Boundaries



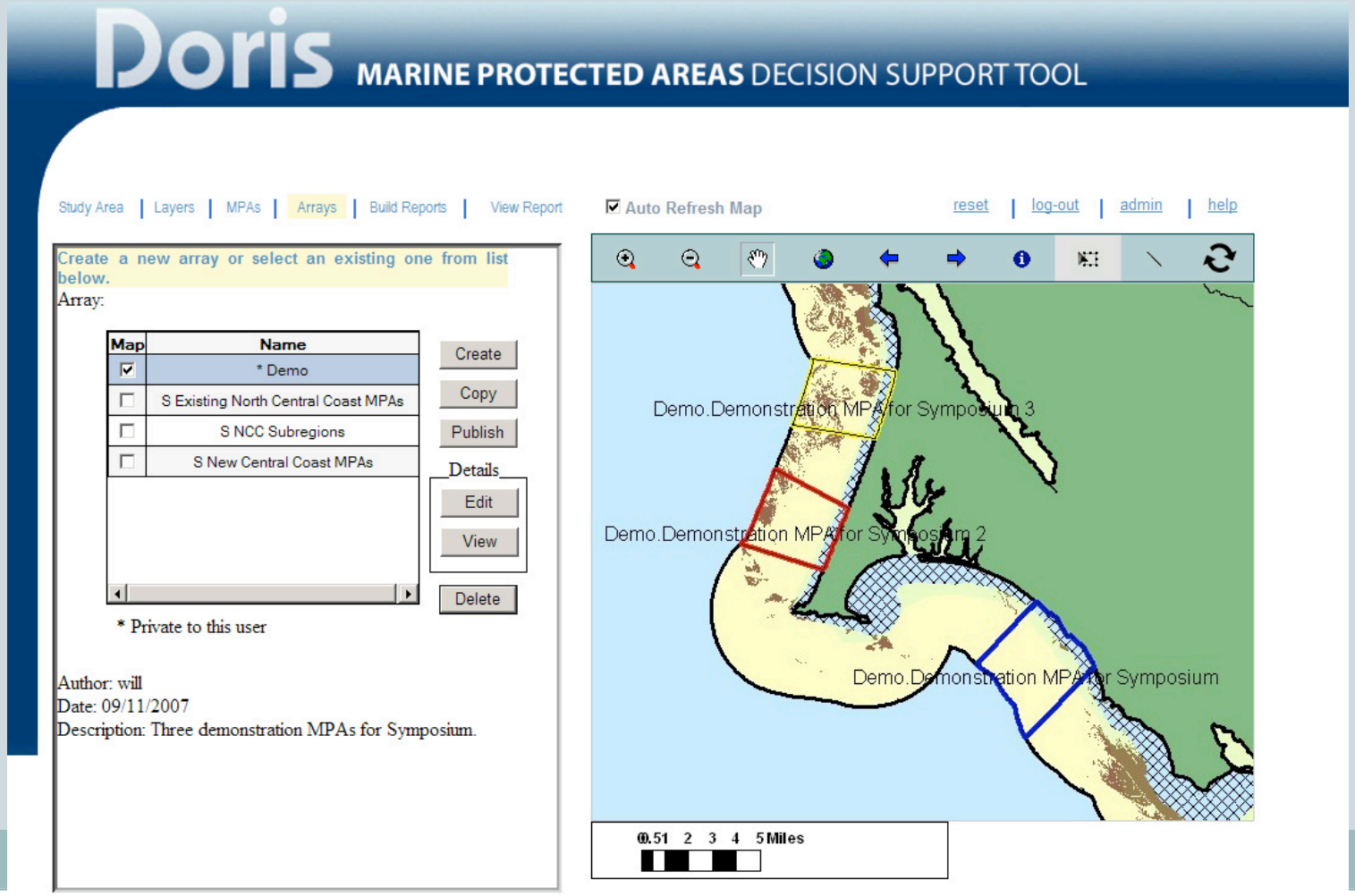
Doris: Prospective MPA Metadata

When saving new prospective MPA boundaries, users must enter information



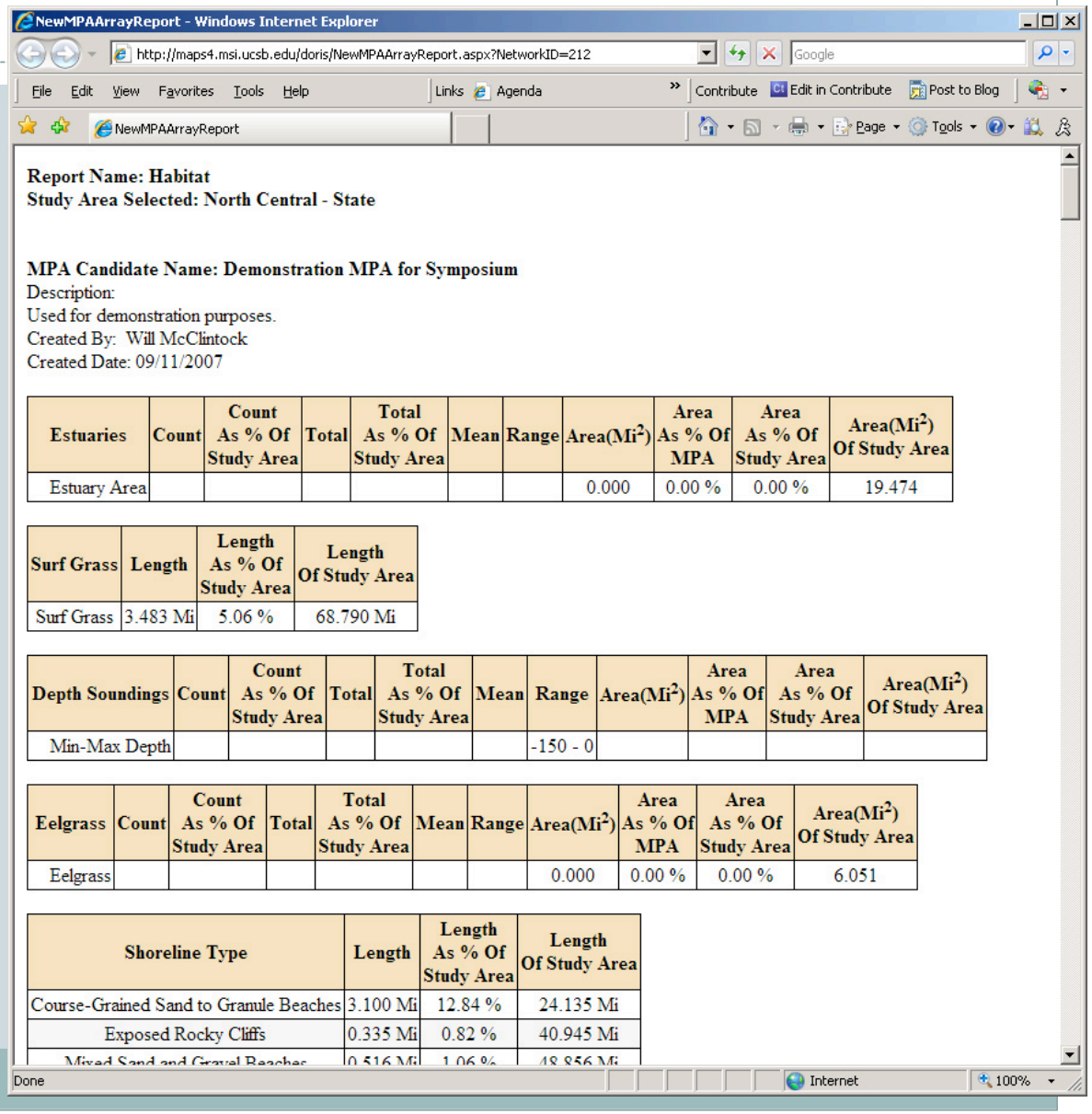
Doris: MPA Arrays Page

Users may choose existing arrays or create new arrays



Doris: Report Results

- Report Results
  - MPA Area
  - Amount of area covered by any given data layer within MPA relative to entire study area
  - Distance between MPAs
  - Metadata
  - Key to results



NewMPAArrayReport - Windows Internet Explorer

http://maps4.msi.ucsb.edu/doris/NewMPAArrayReport.aspx?NetworkID=212

File Edit View Favorites Tools Help Links Agenda Contribute Edit in Contribute Post to Blog

NewMPAArrayReport

Report Name: Habitat
Study Area Selected: North Central - State

MPA Candidate Name: Demonstration MPA for Symposium
Description:
Used for demonstration purposes.
Created By: Will McClintock
Created Date: 09/11/2007

Estuaries	Count	Count As % Of Study Area	Total	Total As % Of Study Area	Mean	Range	Area(Mi^2)	Area As % Of MPA	Area As % Of Study Area	Area(Mi^2) Of Study Area
Estuary Area							0.000	0.00 %	0.00 %	19.474

Surf Grass	Length	Length As % Of Study Area	Length Of Study Area
Surf Grass	3.483 Mi	5.06 %	68.790 Mi

Depth Soundings	Count	Count As % Of Study Area	Total	Total As % Of Study Area	Mean	Range	Area(Mi^2)	Area As % Of MPA	Area As % Of Study Area	Area(Mi^2) Of Study Area
Min-Max Depth						-150 - 0				

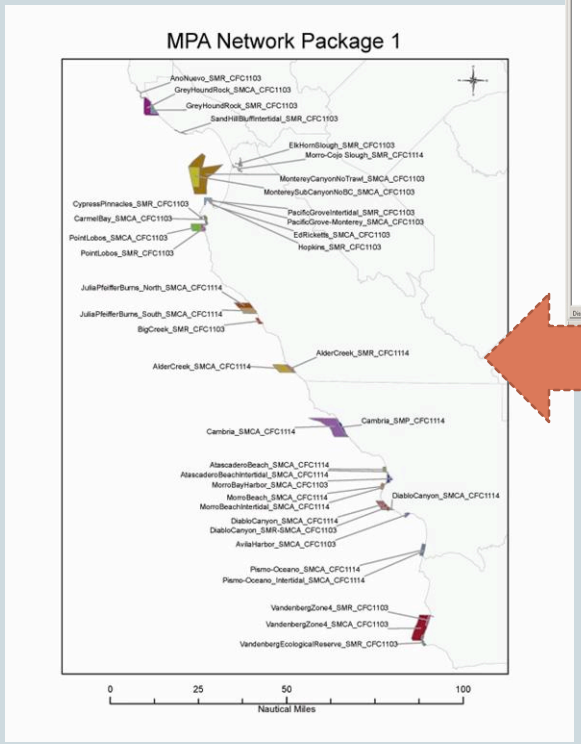
Eelgrass	Count	Count As % Of Study Area	Total	Total As % Of Study Area	Mean	Range	Area(Mi^2)	Area As % Of MPA	Area As % Of Study Area	Area(Mi^2) Of Study Area
Eelgrass							0.000	0.00 %	0.00 %	6.051

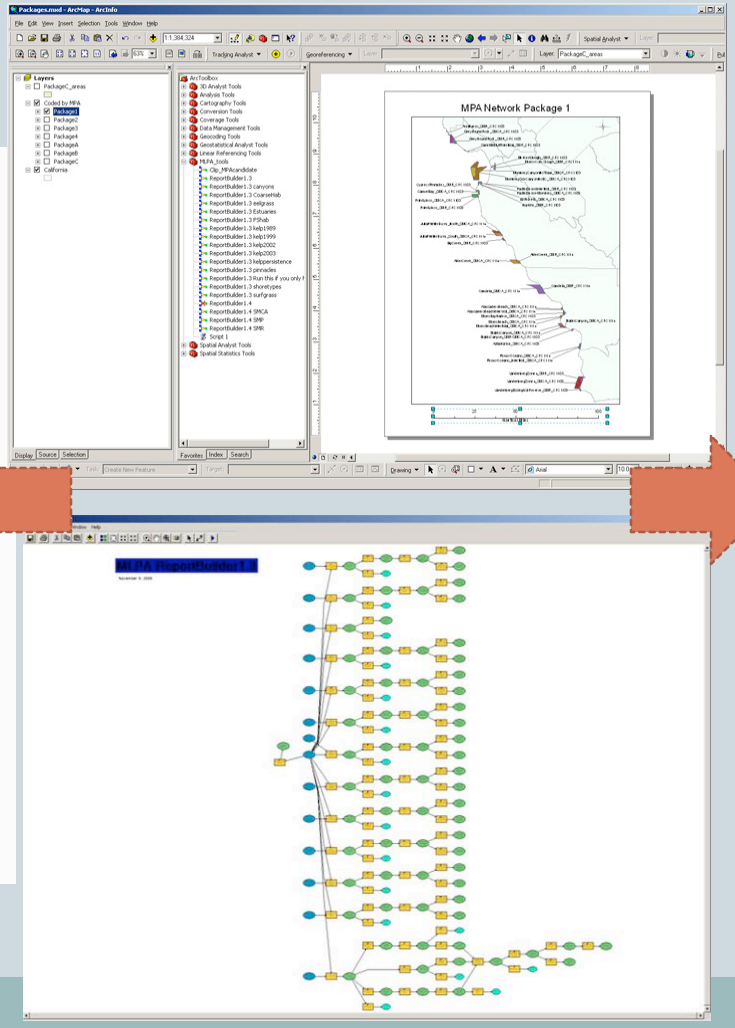
Shoreline Type	Length	Length As % Of Study Area	Length Of Study Area
Course-Grained Sand to Granule Beaches	3.100 Mi	12.84 %	24.135 Mi
Exposed Rocky Cliffs	0.335 Mi	0.82 %	40.945 Mi
Mixed Sand and Gravel Beaches	0.516 Mi	1.06 %	48.856 Mi

Done Internet 100%

ArcGIS Desktop Tools for Maps and Analysis

Creating Maps





Creating Reports

MLPA DATA Report

Area in Statute Miles:	Name of First Area		
13.96	SS_PurisimaPRBO_SMR		
ShoreType:	Length:	Total:	% of Total:
Sandy or	3.522	223.66	1.57%
Rocky intertidal	2.409	209.21	1.15%
Coastal marsh		36.53	
Tidal flats		23.48	
Surfgrass:	Length:	Total:	% of Total::
Eelgrass:	Area:	Total:	% of Total:
		1.07	
Estuary Habitat:	Area:	Total:	% of Total:
		4.410	
Distribution of data resolution			
High:	Low:	Total Area:	%High
5.63	8.33	13.95	40.32%
Fine Scale Habitat:		Area:	Total:
0 - 30m Sediment		0.101	24.21
30 - 100m Sediment		0.692	93.72
100 - 200m Sediment			1.93
200 - 3000m Sediment			0.29
0 - 30m Rocky Structure		3.584	20.16
30 - 100m Rocky Structure		1.248	20.59
100 - 200m Rocky Structure			0.4
200 - 3000m Rocky Structure			0.01
0 - 30m NoData		1.864	
30 - 100m NoData		6.464	
100 - 200m NoData			
200 - 3000m NoData			
Coarse Scale Habitat:		Area:	Total:
Rocky 0 - 30		5.427	46.66
Rocky 30 - 100		1.248	26.78
Rocky 100 - 200			13.91
Rocky 200 -			16.16
Rocky 3000+			
Soft 0 - 30		0.110	294.14
Soft 30 - 100		7.155	575.78
Soft 100 - 200			58.46
Soft 200 -			105.52
Soft 3000+			
unknown		0.034	

% Low:	
59.68%	
% of Total::	
0.42%	
0.74%	
17.78%	
6.06%	
% of Total:	
11.63%	
4.66%	
0.04%	
1.24%	

Summary of Existing Support Tools

- What we have:
  - Large database of geospatial information
  - Web-accessible, interactive map of all data
  - Doris: MPA design and analysis tool
  - ArcGIS Desktop-based analytical and cartographic tools

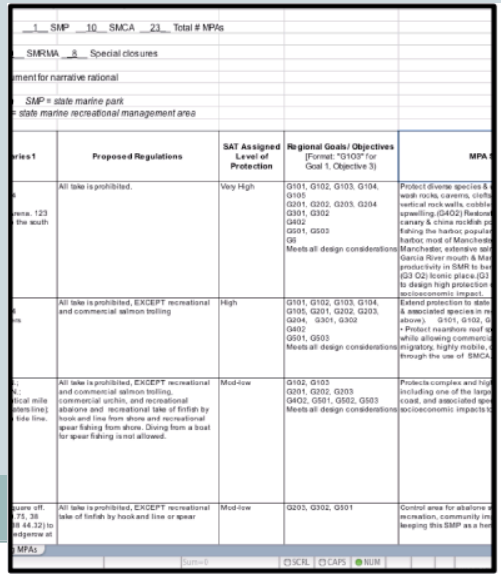
Summary of Existing Support Tools

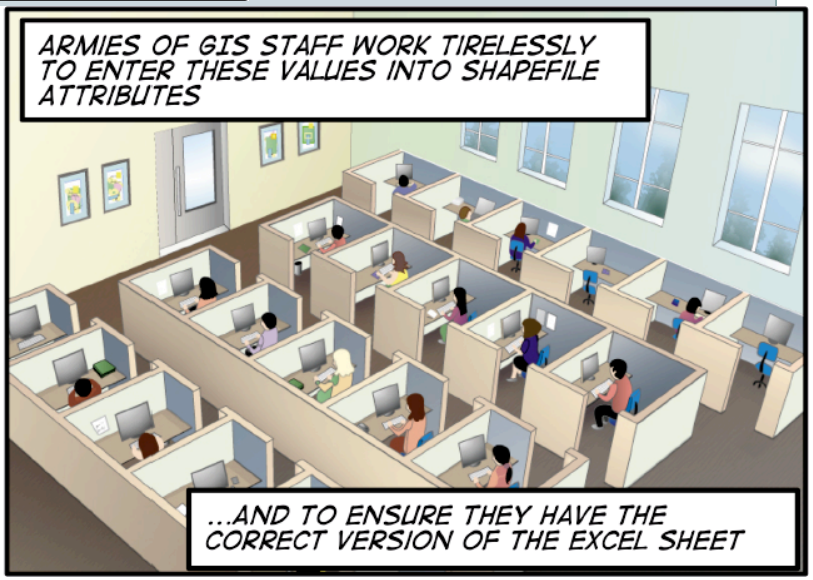
- What we have:
  - Large database of geospatial information
  - Web-accessible, interactive map of all data
  - Doris: MPA design and analysis tool
  - ArcGIS Desktop-based analytical and cartographic tools

- However….
  - Kludgy interface
  - Reports are ugly and hard to interpret
  - Can’t save and share map views or reports
  - No direct means to share and discuss results online

Integrating offline work into the workflow

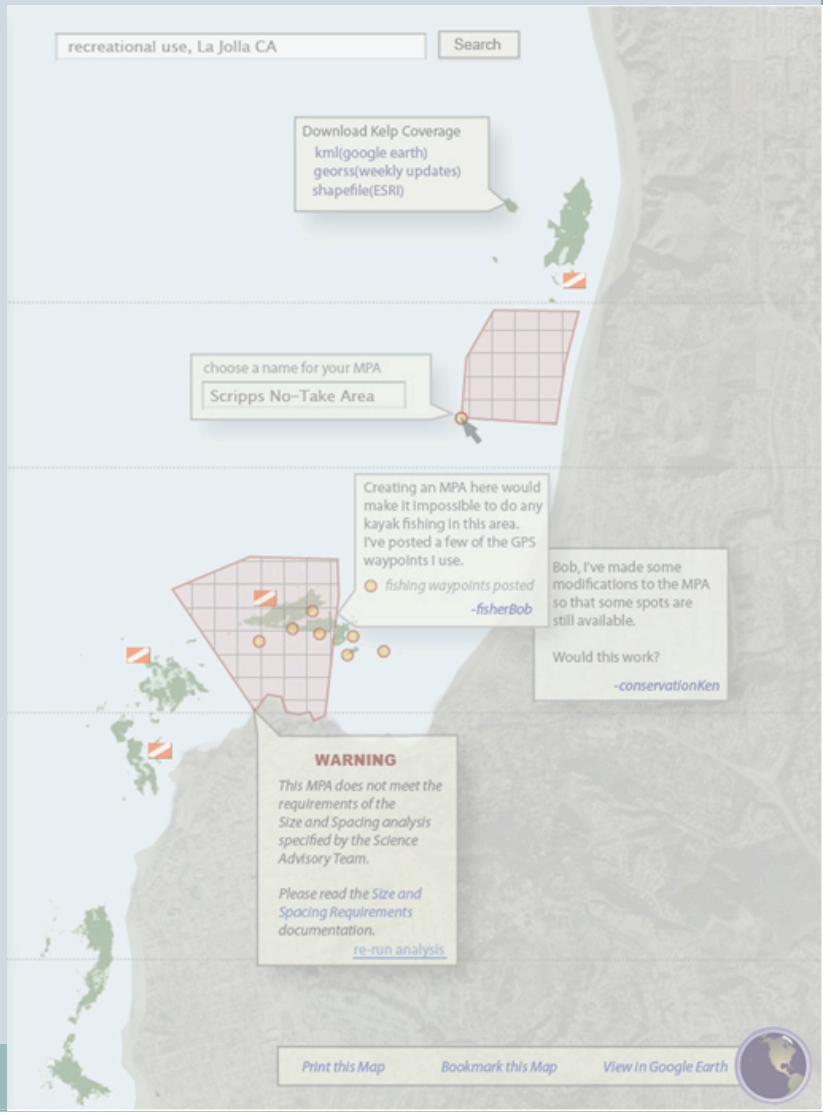
…and then…





New Directions for September, 2008

- Spatially enabled discussion forums
- Sharing dynamic map views
- Sharing reports (with graphics)
- Wiki for collaborative proposals
- Instant feedback re: meeting SAT guidelines (i.e., validation rules)
- Enhanced metadata viewing
- Enhanced mechanisms for integrating offline work (e.g., in ArcMap, Excel)
  - Importing / exporting shapefiles, KML
  - Using ODBC applications (e.g., Excel) to edit attributes if needed.
- Extensible for inclusion of additional models (e.g., Economic, Marzone)



MarineMap for World-Wide Protected Area Design

- Framework for global extent
  - User defined study areas
  - User provided content
- Open source software
  - Low cost
  - Modifiable

Acknowledgments

- Resources Legacy Fund Foundation
- Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO)
- California Department of Fish and Game
- The Nature Conservancy
- Ecotrust
- National Oceanic and Atmospheric Association (NOAA)
- IM Systems Group, Inc.

For more information: http://marinemap.org/mlpa