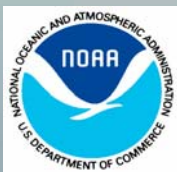

SIMS: A Shellfish Information Management System for Molluscan Shellfish Growing Waters



NOAA Technical Memorandum NOS NCCOS 17

This report has been reviewed by the National Ocean Service of the National Oceanic and Atmospheric Administration (NOAA) and approved for publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for their use by the United States government.

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SIMS: A Shellfish Information Management System for Molluscan Shellfish Growing Waters

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Executive Summary

The Shellfish Information Management System (SIMS) is a web-based application designed in partnership with the Interstate Shellfish Sanitation Conference (ISSC) to integrate information important to coastal managers responsible for ensuring the safe harvest of molluscan shellfish. While the primary purpose of SIMS is to map and analyze waters classified for shellfish harvesting, both the functionality and content of SIMS can be applied to broader questions regarding coastal environments. Through discussions and consensus within the ISSC, NOAA's National Ocean Service, Center for Coastal Environmental Health and Biomolecular Research (CCEHBR) took the lead in the effort to build SIMS beginning in 1998. The preliminary stages involved partnerships with coastal states, EPA, and FDA to identify information and potential products to be included in SIMS, as well as designing the initial systems architecture.

Over several years, NOAA/CCEHBR brought many other complementary data layers into SIMS and worked often at the edge of technology to develop, design, re-design and complete a database with functionality that addresses the needs of shellfish resource managers. Progress on SIMS has been demonstrated to ISSC members, including the state shellfish programs, FDA, and EPA through updates at ISSC meetings and by announcing links to the SIMS website. The development and implementation phases of SIMS are complete. SIMS is now a functional web-accessible, GIS-based, relational database that includes substantially more functionality than first envisioned. In addition, NOAA/CCEHBR has contributed considerably to populating the database by working with a number of states (AL, DE, FL, GA, LA, MD, MS, NJ, OR, SC, TX, VA, WA) to obtain full or partial datasets. With participation from additional states, SIMS should fully serve the intended purposes of the ISSC and its members.

This complete report on SIMS includes an overview of the system, technical specifications, a user's guide and metadata, as well as recommendations and cost estimates to transfer SIMS to an appropriate agency dedicated to maintaining the system. We will continue to work with coastal states through September 2005 to add any outstanding, readily available state data into SIMS. We will also work with the ISSC and its Executive Office through the end of 2005 to transition SIMS to an appropriate 'caretaker.' While the overall investment and maintenance required to continue SIMS is not extensive, it will require a dedicated caretaker to promote and expand the system. Once transferred, the primary responsibility of the SIMS manager will be managing data, interacting with states to accept new and updated data layers, and refreshing and periodically uploading data to SIMS.

The future of SIMS will depend on the active participation of its users and the ISSC. The recommendations of NOAA/CCEHBR to the ISSC in regards to SIMS include:

- Encourage full participation among ISSC members.
- Migrate SIMS from a research facility, CCEHBR, to an appropriate manager.
- Consider the SIMS data model a standard to facilitate data sharing and analysis.
- Explore new and emerging technologies such as web services to communicate with remote databases and linking Internet Map Servers to better integrate tools and data.

I. INTRODUCTION

The Shellfish Information Management System (SIMS) is a web-based application designed in partnership with the Interstate Shellfish Sanitation Conference (ISSC) to integrate information important to coastal managers responsible for ensuring the safe harvest of molluscan shellfish. While the primary purpose of SIMS is to map and analyze classified waters, both the functionality and content of SIMS can be applied to broader questions regarding coastal environments.



The goal of SIMS is to provide spatial information on molluscan shellfish growing areas and water quality for state and federal partners and others concerned with safety in the consumption of shellfish. Further, the health and condition of shellfish and the quality of the waters in which they reside provide an important indicator of the health of coastal ecosystems useful to resource and land use managers.

The ISSC was formed in 1982 to foster and promote molluscan shellfish sanitation and safety in the U.S. through the cooperation of state and federal control agencies, the shellfish industry, and the academic community. To achieve this purpose, the ISSC adopts uniform guidelines and procedures on the harvest, handling and transportation of shellfish. These practices are incorporated into the National Shellfish Sanitation Program, under primary federal oversight of the Food and Drug Administration, and are implemented by state shellfish control agencies.

NOAA has been represented on the Executive Board of the ISSC since its formation and participates in a scientific support and advisory role to the Conference consistent with the purpose of the ISSC and NOAA's Ecosystem Goal and ecosystem approach to management. Classification of waters approved for shellfish harvest is based on state-conducted shoreline surveys for potential sources of contamination and levels of fecal bacteria in water. Shellfish harvest area closures are a primary and visible measure of coastal water quality. NOAA conducts monitoring and research activities addressing major water quality issues, including harmful algal blooms, chemical and microbial contaminants, and eutrophication. NOAA very actively participates in the ISSC as a forum for technology transfer and outreach on these and related issues affecting safety in the consumption of shellfish, as well as the management and mitigation of the impacts of contaminants in shellfish harvest areas.

A. Brief history of SIMS: What was planned and how it evolved.

SIMS was conceived by members of the ISSC as a tool for managing, visualizing, and reporting information on shellfish growing waters. The ISSC has long recognized the potential of a web-accessible, GIS database system to "...improve states' capability to manage shellfish safety and resources." An ISSC Prospectus drafted in the 1990s indicated the value of a system, regularly updated, as a means to track trends in shellfish growing water classification over time. The database would replace the five

year retrospective classifications previously compiled in the NOAA National Ocean Service National Shellfish Register (The 1995 National Shellfish Register of Classified Growing Waters. Office of Ocean Resources Conservation and Assessment, National Ocean Service, National Oceanic and Atmospheric Administration, U. S. Department of Commerce, August 1997).

Through discussions and consensus within the ISSC, NOAA's National Ocean Service, Center for Coastal Environmental Health and Biomolecular Research (CCEHBR) took the lead in the effort to build SIMS beginning in 1998. The preliminary stages involved identifying information and potential products to be included in SIMS, as well as designing the initial systems architecture. A survey of four states (South Carolina Department of Health and Environmental Control, Washington State Department of Health, Florida Department of Environmental Protection, and New Jersey Department of Environmental Protection) was conducted in November 1998 to assess their interests, needs and status of GIS software and personnel.

In February, 1999 a workshop was held to further refine state shellfish program needs and determine which data layers and tools would be useful to state shellfish programs. The EPA and FDA also participated in this workshop. Based on these discussions, agreement was reached on the spatial data layers and basic GIS and analysis tools to assist shellfish managers to be included in SIMS. It was suggested at this time, that SIMS include the location of shellfish program water quality monitoring sites for fecal coliform, as well as locations of marinas. The states also requested that SIMS include a Shellfish Program Profile component where states could provide a host of information about their individual programs, responsibilities, operations, contact information and more.

In May 1999 information on the SIMS project was presented to the Gulf of Mexico Program in New Orleans, LA. By November 1999, the first prototype of SIMS was built and tested. The original version of SIMS was built using Oracle and ESRI's Spatial Data Engine (SDE). The SIMS database housed at CCEHBR was accessed by the state shellfish managers using their local GIS software and an open database connection (ODBC). In this manner, users were able to interact directly with the SIMS database from their desktop GIS environment.

In March, 2000 several additional states were introduced to SIMS at a workshop held in Atlanta, GA which included participants from many of the Gulf of Mexico and east coast states (AL, TX, MS, MD, VA, NC, DE, LA), along with EPA and FDA. Over the last several years, SIMS has been presented at various shellfish conferences and at several meetings of the ISSC, including a workshop held at the Gulf and South Atlantic States Shellfish Conference (GSASSC) in Key West, FL in 2003. Throughout 2004, individual meetings were held with state shellfish program personnel in Delaware, Maryland, Florida, Washington, and Oregon (see Appendix B for a complete list of communications with SIMS partners). As SIMS evolved, improvements in spatial databases and web-based mapping applications, as well as issues related to IT security, precipitated a shift toward accessing SIMS through a web browser using Microsoft technology.

The earliest agreement between the ISSC Executive Board and NOAA/CCEHBR envisioned SIMS as a web-accessible, GIS database that would allow users to determine the status of shellfish growing area classifications. These classifications do not change frequently, so annual updates would seem to be adequate to reflect the

current status of shellfish growing waters. The database could be used to map shellfish growing areas and calculate the area of growing waters by classification type at the state, regional, or national scale. By archiving state data, queries could show changes in acreage by class over time. Standardizing processes among states would be an efficient means to receive, update, and upload spatial data layers.

Over several years, NOAA/CCEHBR brought many other complementary data layers into SIMS and worked often at the edge of technology to develop, design, re-design and complete a database with functionality considerably beyond that originally planned. CCEHBR worked with EPA, additional states beyond the pilot four, other components of NOAA, and commercial spatial data and IT specialists to complete SIMS. Further, progress on SIMS was demonstrated to ISSC members, including the state shellfish programs, through updates at ISSC meetings and by announcing links to the SIMS website.

The most extensive additional feature NOAA/CCEHBR developed at the suggestion of some states was the capability to add fecal coliform data to SIMS. This additional functionality makes it possible to easily run statistical analyses of fecal coliform data on-line, modeling the approach used by states in determining the harvest classification of distinct growing areas. NOAA/CCEHBR developed this and related functions as "value added" utilities to help support the ISSC, states and coastal shellfish management in general.

To date, the database development phase is complete and SIMS is functional for all capabilities originally conceived and numerous other value added utilities. During 2004 and 2005, NOAA/CCEHBR expanded the database population phase, working actively with a variety of states to demonstrate SIMS, encourage their participation, and provide support to help states incorporate the primary spatial data crucial to SIMS. Some state agencies have also shown interest in the fecal coliform component of SIMS and have provided additional support and data to develop this aspect of the application. The database population phase is under way and progress is contingent on input from state agencies. At this point, plans for the long-term maintenance phase must be decided upon by the ISSC. With the delivery of this product to the ISSC, CCEHBR will assist in the transition of SIMS to the appropriate organization named to house, update, and maintain SIMS.

B. How SIMS is used

Internet technology makes it possible to bring together information that was once compartmentalized and disconnected into a common environment to be shared among those that produce and use that information. With desktop access to the Internet, any interested user can easily access and use the information in SIMS. General information available on the SIMS web pages explains the history of SIMS, the capabilities of the system, and the role of state agencies and others in the management of shellfish waters. The web-based GIS component of SIMS has analysis tools built in and makes it possible to view:

1. maps of shellfish harvest classifications nationwide
2. locations of marinas and water quality stations
3. physical features such as rivers and watershed boundaries and
4. information on river gauges, impaired waters listings, and the location of National Weather Service rainfall stations.

C. Current status and 2005 tasks

NOAA/CCEHBR, working with the ISSC and volunteer partner states, has completed the development and implementation phase of SIMS. It is now a functional web-accessible, GIS-based, relational database with considerably more capability than originally planned. Final improvements to the SIMS interface and database design were completed in May 2005. Likewise, complete documentation on SIMS, including general information, metadata, technical specifications, user guide, and recommendations/cost estimates to transfer SIMS to an appropriate agency dedicated to maintaining the system is available. NOAA/CCEHBR has gone beyond its commitments and included more data and functionality than first agreed to and contributed considerably to the database population phase. NOAA/CCEHBR will conclude its support to the database population phase by September 2005 and will work through the end of 2005 with ISSC and its Executive Office to transition SIMS to an appropriate “caretaker” and encourage states’ participation in SIMS. With participation from additional states, SIMS should fully serve the intended purposes of the ISSC and its members and may have utility as well for broader applications in coastal planning and management. The remaining tasks for NOAA/CCEHBR include:

1. Work with active states (DE, VA, MS, MD, NJ, FL, WA, SC, OR, TX, LA, AL, GA) to add any outstanding, readily available state data into SIMS. Prepare a final version of metadata that includes processing rules for loading data from each state (August 2005). (Remaining states include: NC, NY, MA, ME, NH, CT, RI, AK, CA, HI).
2. Assist ISSC in transferring SIMS to an appropriate organization responsible for management of the system (December 2005).

II. GENERAL DESCRIPTION OF THE SYSTEM

The Shellfish Information Management System employs emerging Internet and spatial database technologies to integrate, access, visualize, and analyze data through web-based applications. SIMS is designed to:

1. Facilitate sharing and dissemination of information within the ISSC.
2. Provide information related to the condition of coastal waters, shellfish growing area classifications and water quality monitoring by state shellfish programs.
3. Aid the states in defining and mapping growing area classifications and establish links to complementary coastal information nationwide.
4. Facilitate queries and summaries of shellfish waters at the state, regional, and national level.

SIMS has two major components: SIMS_Web and SIMS_GIS.

A. SIMS_Web: SIMS homepage

SIMS_Web is a web-based application that gives an overview of SIMS and information on how states can participate. This component also provides an interface to exchange information important to shellfish programs within each state. This includes information such as GIS software and hardware used, agency responsibilities, and contacts.

* URL: http://205.156.31.24/sims_web

* SIMS_Web provides an overview of the SIMS project and objectives (Figure 1).

* A password-protected web interface allows state agencies to insert, update, and delete information about their program. Through a web browser, state agencies can securely enter and edit their information on GIS capabilities, responsibilities, contacts and more into the SIMS database (Figure 2).

* The SIMS web application allows the public to view general information about each state shellfish agency (Figure 3).

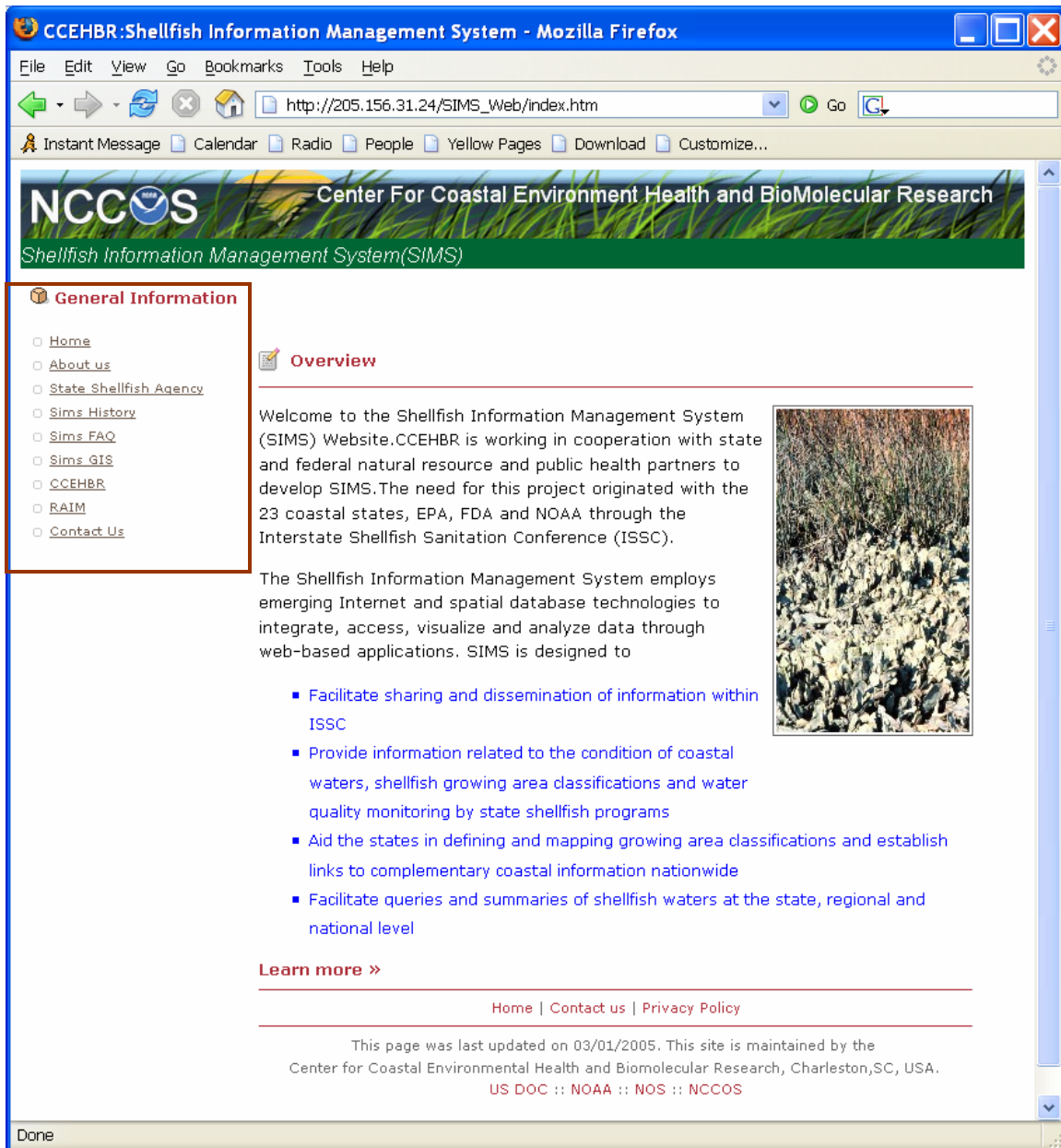


FIGURE 1. SIMS_Web Homepage: http://205.156.31.24/sims_web

ProgramsBis - Mozilla Firefox

File Edit View Go Bookmarks Tools Help

http://205.156.31.24/SIMS_Web/SPI/Programs.e

Instant Message Calendar Radio People Yellow Pages Download Customize...

Shellfish Information Management System

Shellfish Programs Information

State:

Program Name: Nbr of Personnel:

Address:

City: State: Zip:

Division: Department:

Web Address: >>

Mission Statement:

Done

FIGURE 2. SIMS_Web. Password-protected web interface for collecting and editing state shellfish program information.

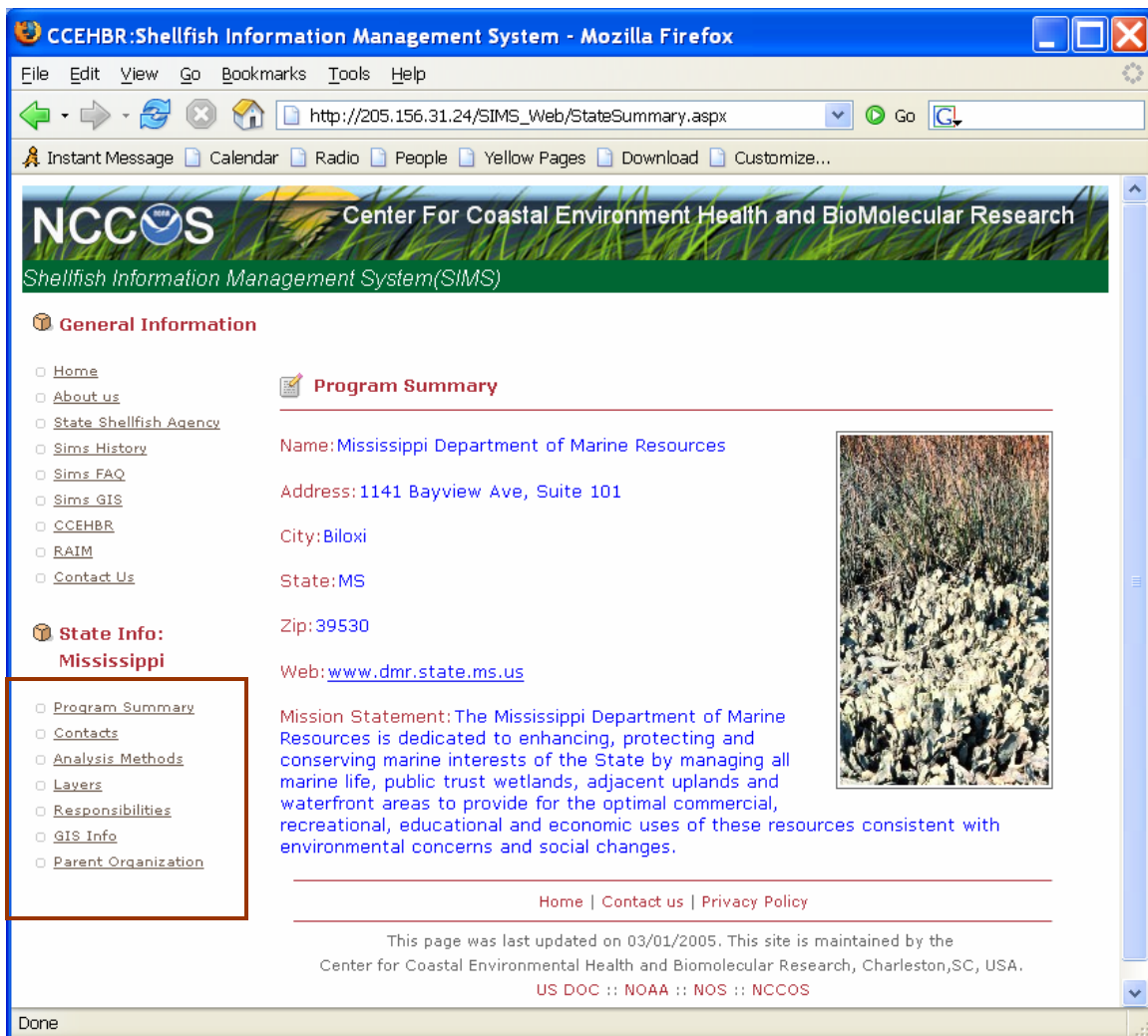


FIGURE 3. SIMS_Web. Information available on state shellfish programs accessible to the public.

B. SIMS_GIS: Web-based GIS application.

The second component, SIMS_GIS, serves spatial data of interest to coastal resource managers through a standard web browser using an internet map server (ArcIMS), ESRI's Spatial Data Engine, a .NET web application and SQL Server.

The GIS component of SIMS provides tools to run fecal coliform statistics using state data or data provided to EPA's STORET database <http://www.epa.gov/STORET>. Other tools allow the user to calculate area of classified waters, examine trends in growing water classifications, and access near-real time information from river gauges. In addition, shapefiles of water quality stations, shellfish growing areas, marinas, and the 1995 NOAA National Shellfish Register can be extracted. Data from SIMS can be used in conjunction with other environmental and land use management data to address a variety of questions.

- * URL: http://205.156.31.24/SIMS/CCEHBR_Viewer/main_frame.aspx
- * SIMS_GIS combines spatial data from various agencies (Figure 4) and permits basic GIS map rendering.
- * State shellfish programs can use their data in conjunction with other data layers related to shellfish waters in a web-based GIS environment (Figure 5).
- * SIMS_GIS provides tools to run fecal coliform statistics, calculate area of classified waters, summarize trends in growing areas, and access near-real time information from precipitation and river gauges (Figure 5 a, b, c, e).
- * Spatial data layers can be extracted from SIMS as shapefiles (Figure 5d).
- * Help files and metadata are also available (Figure 5 f, g).

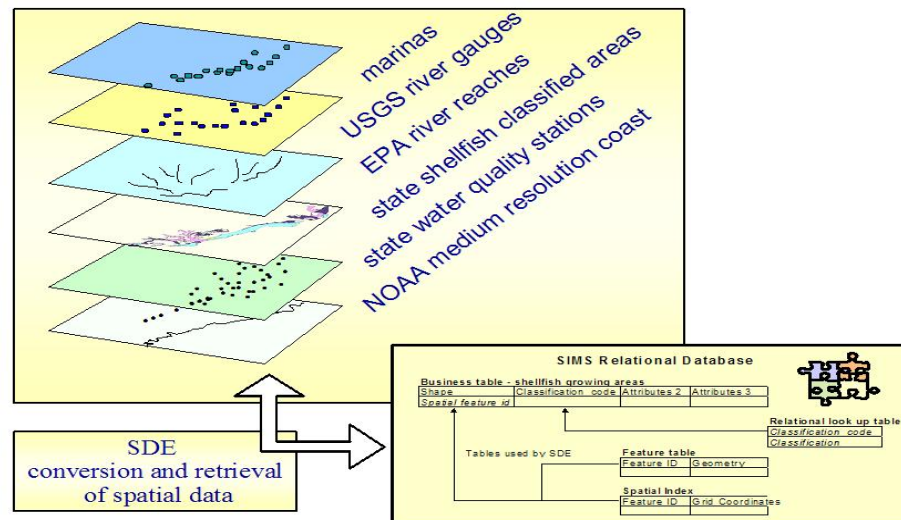


FIGURE 4. Example of multi-agency GIS data layers in SIMS.

The spatial data within SIMS include:

- shellfish harvest area and classification
- location of marinas
- location of water quality monitoring sites
- US shoreline
- 1995 National Shellfish Register
- 303d impaired waters
- Hydrological Unit Codes (HUCs)
- National Weather Service Cooperative stations
- coastal assessment framework (CAF)
- EPA river reaches
- USGS river gauge stations for precipitation and river stage

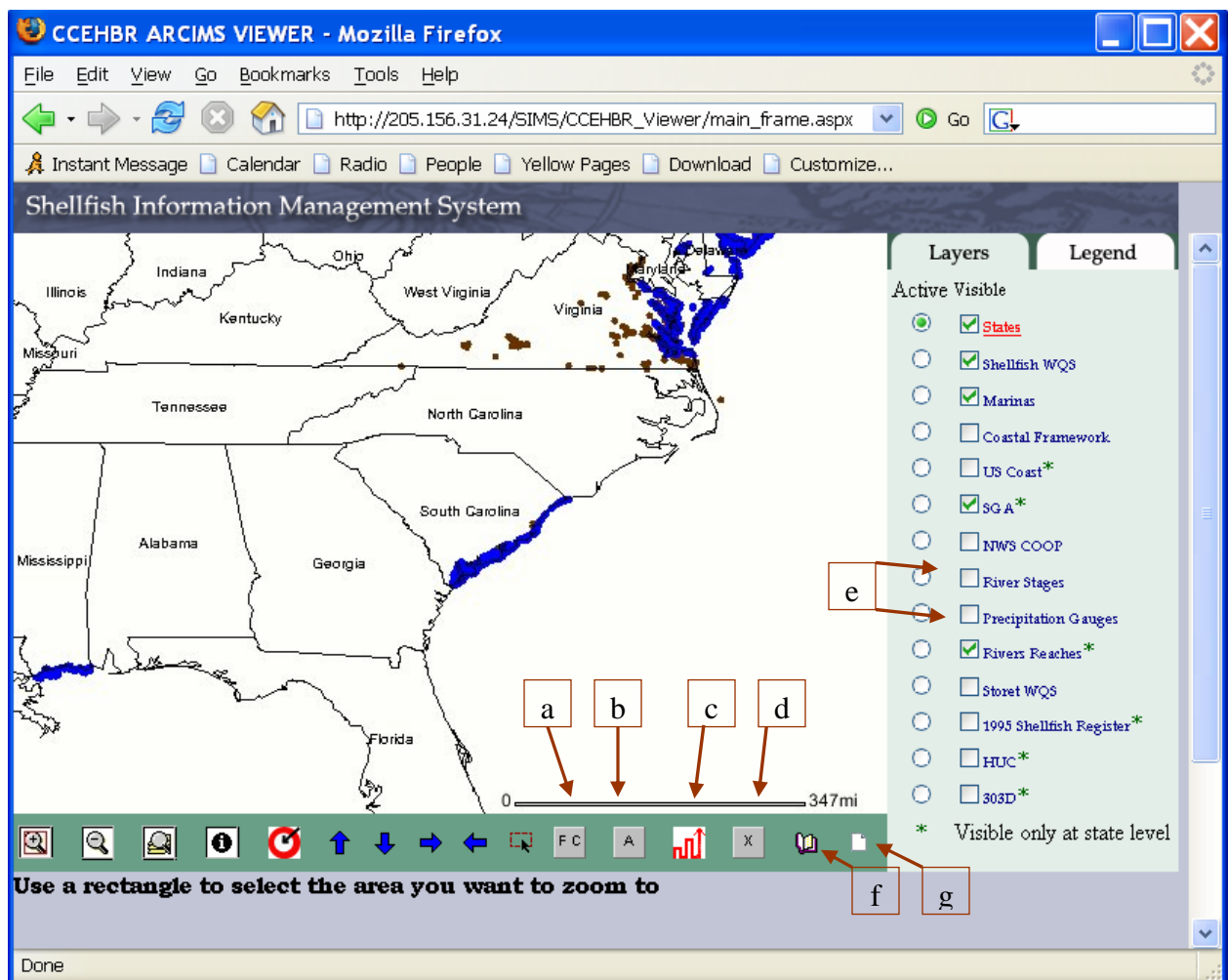


FIGURE 5. SIMS_GIS provides tools to: (a) run fecal coliform statistics, (b) calculate area of growing waters by classification, (c) summarize trends in acres of growing waters (d) extract spatial data layers as shapefiles (e) access near-real time information on river stage and precipitation from USGS river gauges. In addition, a help button (f) and metadata button (g) provide additional information for the user. See Appendix C: User's Manual for complete instructions on using these tools in SIMS.

III. SYSTEM ARCHITECTURE

The architecture of SIMS is made up of two parts: a Web application and a GIS application. The Web application is a means of collecting and disseminating general information about state shellfish programs in the SIMS database through a web interface (Figure 6). The GIS application uses an internet map server (IMS), a relational database, and a spatial data engine to serve spatial data on the Web. It is implemented in N-Tier architecture using ASP.NET and Microsoft SQLServer 2000 (Figure 7).

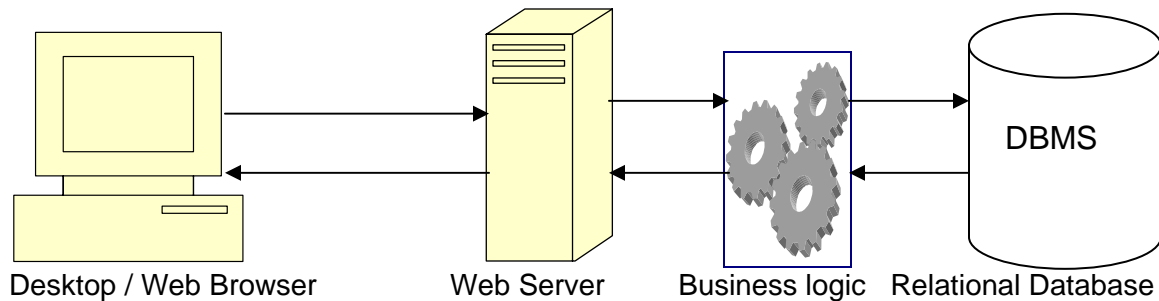


FIGURE 6. System architecture of Web application

The GIS application is an interactive mapping application where users can obtain information on shellfish growing areas, water quality stations and marinas. Some of the functions built into the GIS application include tools to calculate acreage, run fecal coliform statistics, and extract shapefiles. The GIS application is implemented in N-Tier architecture using ESRI ArcIMS, ArcSDE, and ActiveX Connector, as well as Microsoft SQL server and ASP.NET.

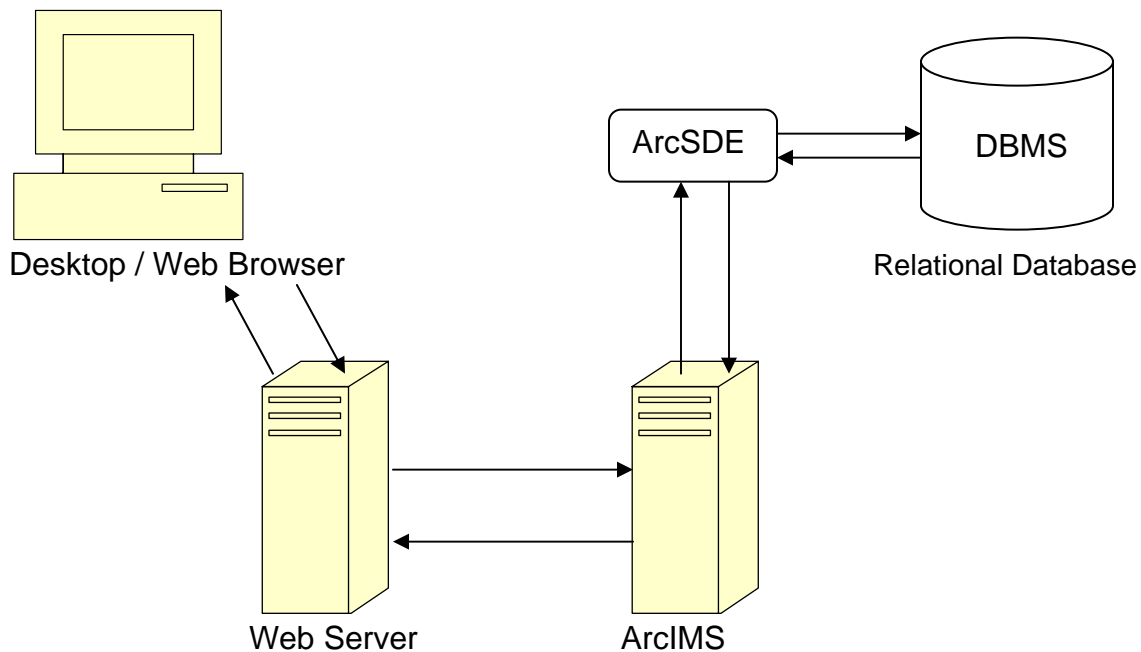


FIGURE 7. System architecture of web-based GIS application

The design and implementation of the SIMS GIS application involved:

1. System analysis and design:
Object oriented Unified Modeling Language (UML) modeling was accomplished using Microsoft Visio.
2. Database implementation:
The object oriented design was translated into a relational database and implemented in SQL Server 2000.
3. GIS implementation:
Access to spatial data stored in the relational database is facilitated by ESRI Spatial Data Engine (ArcSDE) and Internet Map Server (ArcIMS 4.01).
4. Architecture:
N-tier distributed architecture was used to implement the project.
5. Development framework:
Technologies used for development included Microsoft .NET using Visual Studio, ASP.NET, VB.NET, ArcIMS ActiveX connector for GIS connectivity, and ADO.NET for database connectivity.
6. Deployment:
IIS 5.1 was used to deploy the application.
7. Populating the database:
ESRI ArcGIS 9 (service pack 3) is used to load spatial data into the relational database.
8. Data conversion:
GIS conversion of state shellfish, marinas, and water quality station shapefiles to SIMS format is facilitated through a customized interface built in ArcObjects (Figure 8).
9. Database updates:
With each annual update obtained from the states, a new yearly shellfish layer will be generated, allowing for visualization and quantification of trends of classified areas.

The screenshot shows the 'Sims Data Converter' window. At the top, the title bar reads 'Sims Data Converter'. Below the title bar, there are two dropdown menus: 'Source Fields' set to 'Ycoord' and 'Select a State' set to 'Delaware'. Below these, 'Target Fields' is set to 'LATITUDE'. To the right of the 'Target Fields' dropdown is a 'Select Target Layer' section with three radio buttons: 'Marinas' (unselected), 'Water Quality Stations' (selected), and 'Shellfish Growing Area' (unselected). Below the 'Target Fields' dropdown is a text box labeled 'Your selected Fields' containing the following text: 'NAME-->STATION_NA', 'Xcoord-->LONGITUDE', and 'Ycoord-->LATITUDE'. Below this text box are three buttons: 'Continue', 'Convert Now', and 'Exit'. To the right of the 'Continue' and 'Convert Now' buttons is a section titled 'Field Mapping of Delaware' which contains a text box with the following text: 'STATE:Delaware', 'Name=STATION_NA', 'XCOORD=LONGITUDE', and 'YCOORD=LATITUDE'.

FIGURE 8. Interface used by GIS administrator to facilitate the conversion of state shapefiles before loading into SIMS. Conversion of state data to the SIMS model is accomplished by matching field names from state shapefiles with the appropriate field in the SIMS data model. The Field Mapping window in the lower right provides suggested matches based on the existing metadata for the shapefile being converted.

IV. PARTNER PARTICIPATION

A. Current status of state data available in SIMS

The interaction between SIMS and the shellfish agencies varies from state to state for several reasons. Initially, four pilot states were asked to help build a foundation for SIMS. The shellfish agencies in New Jersey, South Carolina, Washington, and Florida have generously committed time, data, and resources to assist in developing SIMS. Beyond the initial four pilot states, the SIMS team introduced the system to other coastal states to broaden the range of GIS capabilities and agency procedures related to classifying shellfish waters represented in SIMS. These partners, too, have provided valuable input and data to develop SIMS. In all, we have worked with thirteen coastal states to determine their interest in SIMS, incorporate their data, and address their needs related to mapping shellfish areas and water quality to the extent possible. States that have been involved with SIMS are able to do so to varying degrees given their resources, organizational structure, concerns about releasing data, and availability of suitable data. While not all shellfish producing states have contributed to SIMS, now that the application is complete, new data from the remaining states can be readily added to the system. Table 1 illustrates the various levels of participation and data provided by states currently involved in SIMS. In addition, a summary of the communications between CCEHBR and the SIMS partners is provided in Appendix B.

Table 1. Current status of state data available in SIMS				
State	Shellfish layer	Marinas layer	WQ Stations layer	Fecal coliform data
AL	no	no	no	
DE	yes	no	yes	yes+
FL*	yes	no	no	
GA	no	no	no	
LA	no	no	no	
MD	yes	no	yes	yes+
MS	yes	no	yes	
NJ*	yes	yes	yes	
OR	no	no	no	
SC*	yes	no	yes	yes**
TX	no	no	no	
VA	yes	yes	yes	yes+
WA*	yes	yes	yes	
*pilot states Remaining states: NC, NY, MA, ME, NH, CT, RI, AK, HI, CA + data provided by state agencies ** data from shellfish agencies provided through STORET				

B. Estimate of time and cost to participate

The time and cost of contributing to SIMS is highly variable depending on the level of in-house GIS software and expertise. In addition, the degree to which digital state maps of shellfish areas are already complete, as well as the methods that were used to produce those maps, will affect whether or not appropriate data exist that can be transferred to SIMS. Minimally, state agencies should have a digital spatial data layer of shellfish growing waters that can be transferred to SIMS. Assuming that the basic hardware, GIS software, GIS skills and a preliminary digital spatial data layer exist, the time commitment for an agency interested in participating in SIMS may be less than 40 hours in the first year. Much of this effort would be concentrated in the initial interactions as the state shellfish agency becomes familiar with SIMS. Some follow-up throughout the first year may be required. Once a relationship with the state shellfish agency is established, the effort in subsequent years to provide updates to SIMS would be minimal.

A best case scenario for a shellfish agency to become involved in SIMS would be one where the basic digital spatial information required for SIMS exists and that data parallels the SIMS model. A summary of the three GIS shapefiles and the field names for each of the state-generated data layers used in the [SIMS data model](#) can be found on the SIMS FAQs page http://205.156.31.24/SIMS_Web/simsfaq.htm and at the end of the User's Manual (Appendix C). Some states may find it helpful to use the shellfish data layer that was developed through the Shellfish Register effort in 1995 as a starting point and update it to reflect current conditions. This data can be extracted from the SIMS GIS application. In the case where the resources mentioned above do not exist, only a general estimate of costs can be given here (assuming minimum hardware, operating system, and internet access is available).

1. GIS software (such as ESRI Arc9) is required to produce digital maps of shellfish areas, locations of marinas, and water quality stations. Depending on the current status of a state's digital data, software needs will vary.

Basic GIS software. (ESRI ArcGIS9 ArcView single use license). Minimal functionality. May be sufficient where complete digital data already exist. \$1400.

or

Advanced GIS software. (ESRI ArcGIS9 ArcEditor, including ArcView single use license). More complete GIS functionality plus the ability to edit/modify shapefiles and build topology. \$6000.

or

Most advanced GIS software. (ESRI ArcGIS9 ArcInfo concurrent use license). Provides a full suite of GIS, editing, and spatial analysis tools. \$7500.

2. The cost to produce digital maps (where none exist) will range widely and generally requires a major commitment from the agency. Developing point data for marinas and water quality stations may be collected using a GPS in the field and can be easily generated from text files containing latitude and longitude. However, producing spatial data layers of classified areas requires building polygons to delineate areas. Methods may include:

- digitizing boundaries of classified areas on-screen within GIS software with scanned paper maps as a background.

- collecting boundary points in the field using a GPS*, building topology in a GIS, and clipping with another spatial data layer such as a shoreline.
- conversion of existing CAD/survey information in GIS.

The time and effort to create spatial data layers for growing waters will depend on the amount of area to be digitized, the complexity of shellfish growing areas shapes, and the amount and type of source information used as a basis for delineating areas.

* Point data (marinas and water quality stations) is typically collected in the field using a GPS, downloaded to a GIS and converted to a spatial data layer. The cost of a GPS unit can range from a few hundred dollars for a basic hand-help unit to \$3500 for a differentially corrected GPS.

3. Training: A basic knowledge of GIS is sufficient to contribute to SIMS. Otherwise, a basic course in GIS and GPS would be sufficient to train an individual on the concepts and procedures needed to be involved in SIMS. There are a variety of venues for training such as university courses, vendor-sponsored training, and occasional courses offered by various institutes that address the needs of environmental scientists. Again, the costs can vary widely from \$500 per person per day for on-site, instructor-led training to \$200 for a two day course (eg. www.csc.noaa.gov).

V. RECOMMENDATIONS FOR THE CONTINUATION OF SIMS

The future of SIMS will depend on the active participation of its users and the ISSC. While the overall investment and maintenance required to promote and extend SIMS is not extensive, it will require a dedicated caretaker to promote and grow the system. This section will focus on what is needed to:

1. transfer SIMS from NOAA/CCEHBR to an appropriate SIMS manager and
2. maintain the system into the future.

A. Requirements for existing configuration

Based on the existing configuration of SIMS, the following hardware, software and skills would be required to transfer and house SIMS. Estimates provided here are based on government pricing for the required hardware and software. Actual pricing may be higher.

Hardware:

Two Dell 2850 Servers (one for ArcIMS, one for ArcSDE)	
3.6 GHz/2MB cache, Xeon, 800 MHz FSB	
Windows 2003 Server standard edition pre installed	
2 @ \$6.5K	\$13,000

Software:

SQL Server 2000	\$ 2,700
ArcIMS	\$ 4,000
ArcSDE	\$ 8,000
Visual Studio.NET (for future customization)	\$ 900
ArcGIS (range - \$ 2K-7K depending on licensing)	<u>\$ 5,000</u>
Hardware and Software TOTAL:	\$33,600

Skills:

- Database administrator (with ArcSDE experience)
- GIS programmer (with .NET, ActiveX connector, ArcIMS, ArcSDE experience)

It is estimated that the staffing commitment to transfer SIMS would involve about 20 hours per week for both the Database Administrator and the GIS programmer over a period of three to four months.

B. Steps to transfer and maintain system

Transferring SIMS would be conducted in the following manner once the appropriate hardware and software is in place:

1. The source code written to customize SIMS would be ported to the new system.
2. Existing data will be recreated in ArcSDE.
3. Services will be recreated in ArcIMS.
4. The .NET project which communicates with the ArcIMS server will be recompiled at the client site.

Approximately three to four months will be needed to complete the transfer and testing of SIMS. Additionally, one month or less will be required to train the GIS programmer to maintain and update subsequent data.

Once transferred, the primary responsibility of the SIMS manager will be managing data, interacting with states to accept updated data layers, and refreshing/uploading the SIMS system every six months with any data submitted since the last refresh. Minimal assistance from an on-site database administrator would be needed.

Time requirement = .25 FTE GIS Programmer.

C. SIMS as a model/standard

Throughout the development of SIMS, it has been necessary to maintain a balance between retaining the approach used by states to manage their shellfish waters and realizing the potential of a national model to reflect the condition of coastal waters. Inasmuch as we have worked toward assimilating disparate state data into a common framework, more could be done if greater consistency among state programs could be achieved. With that in mind, discussion among all members of the ISSC should consider the feasibility of moving toward a common spatial data model for state shellfish agencies.

There are many significant issues involved in transferring data from the states to SIMS. There are discrepancies in how each state defines and classifies its growing waters. Based on input from the states currently involved in SIMS, there are over 20 different labels applied to growing waters that have to be manipulated to conform to the six classifications used by the ISSC and SIMS. Also, for each of the three basic data layers coming from the states, associating the field names used by the state programs with field names used in SIMS is problematic. Often, information provided by states is similar in nature to that found in SIMS, but does not always fit the definition exactly. Likewise, each record in a state data layer should have a meaningful, unique identifier that the states can link back to once the data is brought into SIMS. In addition, complete metadata including the geographic projection and the units for any calculation of area must be provided. While the states may prefer to show trends in area of growing waters as calculated in the projection used by their agency, to examine trends nationally it is necessary to use a common projection so that area calculations are comparable from state to state. (Different projections distort shapes differently, giving different estimates of area). Complete metadata describing the field names and definitions, as well as the projection used, **MUST** be provided by the state. Even then, customized procedures should be implemented to address differences among states.

D. New and emerging technologies

The potential for future applications of SIMS depends on the continued commitment of its users and partners. New and emerging technologies allow SIMS to be integrated into new environments and applications. The SIMS architecture is fully flexible and extensible and supports integration with other systems. For example, there is potential for the SIMS application to interact with other national databases (e.g. EPA STORET) through web services. In addition, ArcXML exchange formats allow for a virtual exchange of spatial data as opposed to a physical transfer of data. In both cases, whether connecting to an internet map server or utilizing web services, security concerns are minimized because the exchange occurs between web servers only. The web

server, in turn, sends a request to the database. There is no direct communication between the underlying databases. The database itself is not exposed to the internet. It remains behind a firewall and is not accessed directly. Through this mechanism, selected data can be provided from relevant databases in a secure way.

Since SIMS is delivered through an Internet Map Server, the contents of the web application are accessible and available to GIS users who can connect to spatial data served on-line. For instance, state shellfish agencies or other GIS users can establish connectivity between their spatial databases and SIMS (and vice versa). This connection can be established very simply through a desktop GIS software (Figure 9). Once connected, users can combine spatial data from their local application with data served through the SIMS web map server without physically exchanging data. Potentially, any site running an ArcIMS server (eg. www.geographynetwork.com) is accessible in this manner. The result of combining SIMS data with other spatial data available on-line is illustrated in Figure 10.

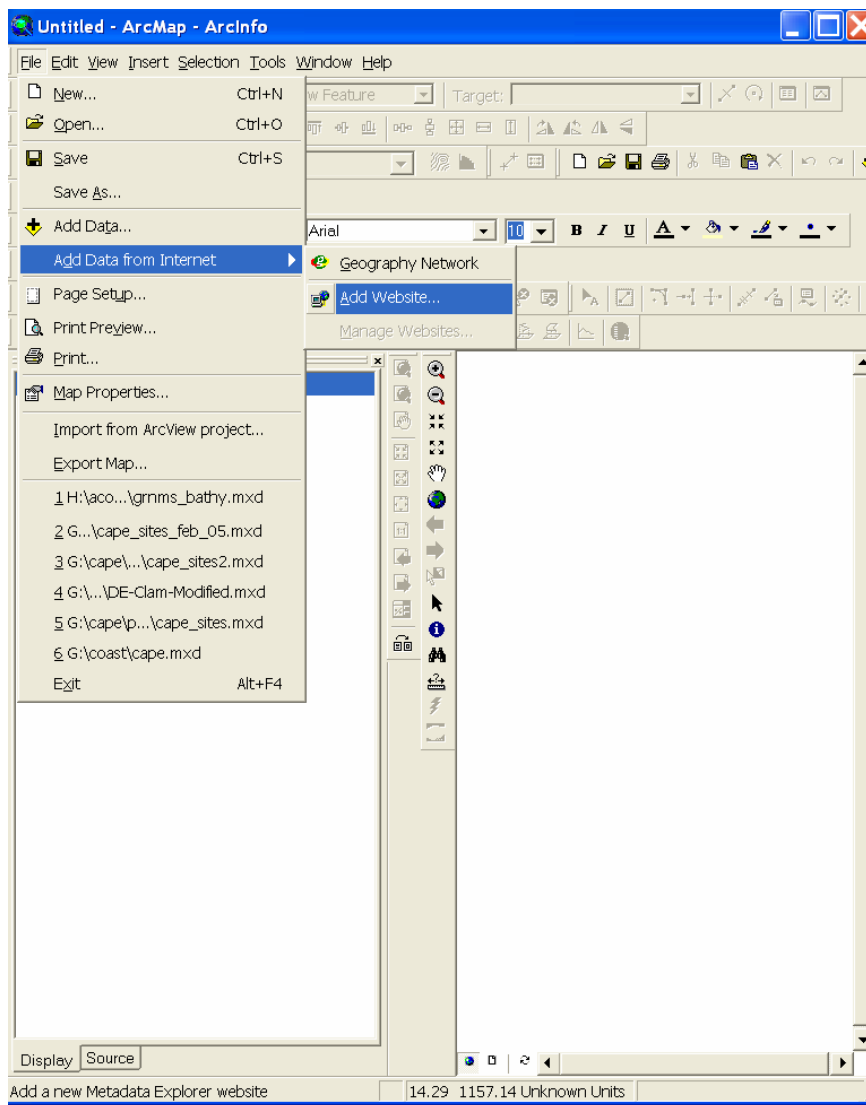


FIGURE 9. Connecting to spatial data on the Internet from a desktop GIS application.

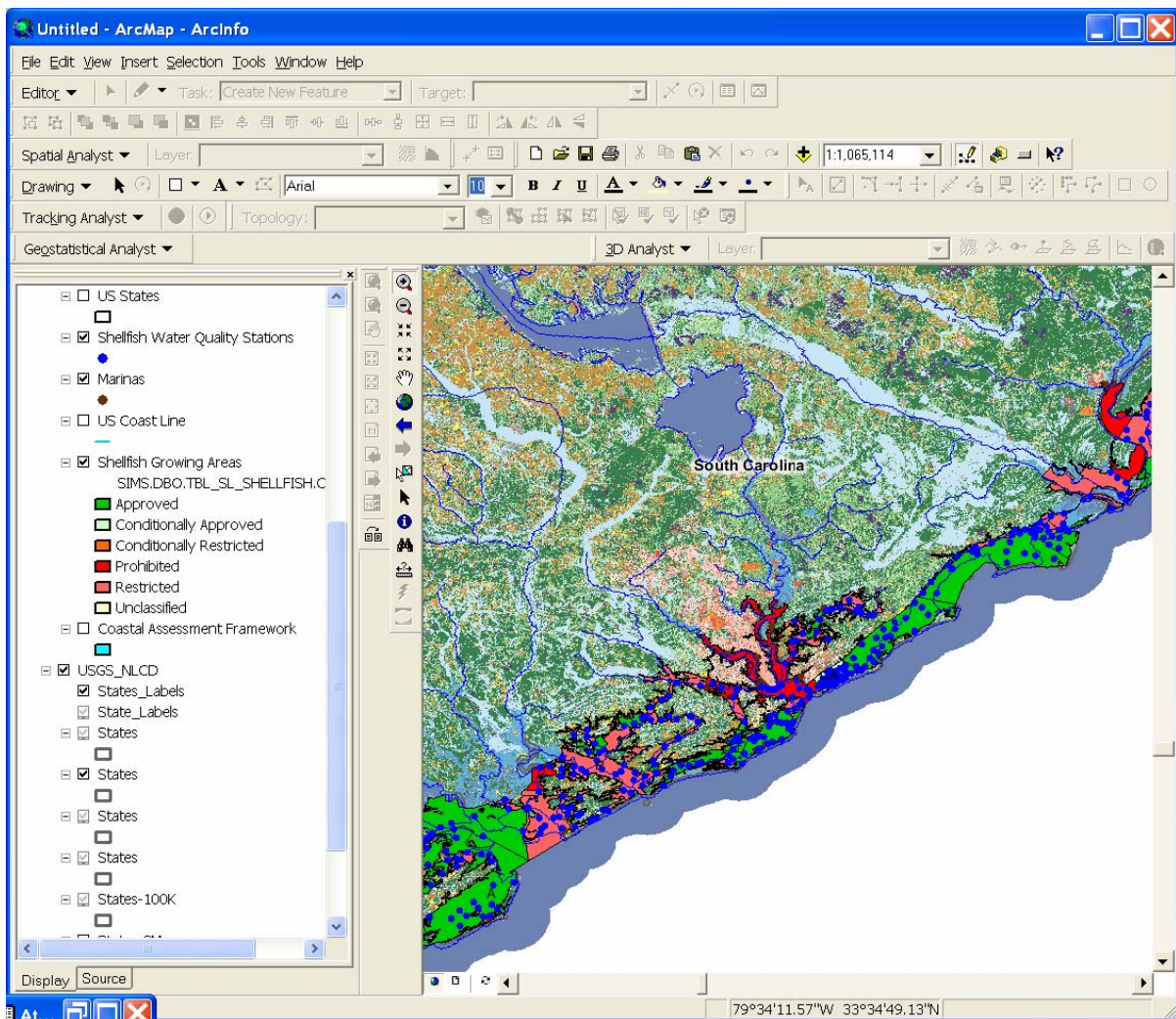


FIGURE 10. Combining SIMS data with spatial data on land cover from USGS in a desktop, GIS environment.

In addition to sharing spatial data, web services can be used as a mechanism to exchange information. Implementing a web service allows other organizations to use the valuable data from remote databases in their applications. For instance, procedures such as calculating fecal coliform statistics can be sent as an XML request to a remote server where a web service is set up. The request from the SIMS application would initiate a program that runs on the web server associated with the water quality database. The requested statistic is run locally and then only the output is returned back to the SIMS application. Building these requests into SIMS would allow for a request to be submitted to a remote database and the results to be integrated into SIMS without having to physically transfer all the data required to complete the request. Again, only the XML output containing the results is returned back to the application that called it.

A variety of data and information resides in related spatial and non-spatial databases that, used in tandem with the information in SIMS, would immensely increase the power

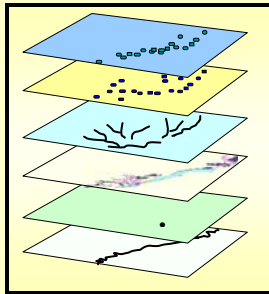
of SIMS. Making use of web services and ArcIMS links to share data can be used to address customized analyses. The data and mechanisms are in place to access and integrate current information without having to store it locally. New efforts such as these would require coordination and commitment from EPA, FDA, NOAA, the shellfish agencies themselves, and the future manager of SIMS.

E. Recommendations

The future of SIMS will depend on the active participation of its users and the ISSC. The recommendations of NOAA/CCEHBR to the ISSC in regards to SIMS include:

- Encourage full participation among ISSC members.
- Migrate SIMS from a research facility, CCEHBR, to an appropriate manager.
- Consider the SIMS data model a standard to facilitate data sharing and analysis.
- Explore new and emerging technologies such as web services to communicate with remote databases and linking Internet Map Servers to better integrate tools and data.

APPENDIX A. SIMS Summary



The Shellfish Information Management System (SIMS) is a web-based application designed to integrate information important to coastal managers responsible for ensuring molluscan shellfish are harvested from areas of acceptable water quality. SIMS is supported by members of the Interstate Shellfish Sanitation Conference (ISSC) as a tool for managing, visualizing, and reporting information on shellfish growing waters. ISSC is comprised of state shellfish agencies, the molluscan shellfish industry, Food and Drug Administration (FDA), Environmental Protection Agency (EPA), and National Oceanic and Atmospheric Administration (NOAA).

* The **SIMS Web** application is a source of information on the SIMS project and objectives as well as state shellfish agencies.

http://205.156.31.24/sims_web

* **SIMS GIS** combines spatial data from various agencies and permits basic GIS map rendering. Data from state shellfish programs can be used in conjunction with other data layers related to shellfish waters in a web-based GIS environment. In addition, SIMS GIS provides tools to run fecal coliform statistics, calculate area of classified waters, and access near-real time information from precipitation and river stage gauges.

http://205.156.31.24/SIMS/CCEHBR/Viewer/main_frame.aspx

* **SIMS FAQs** provides additional information on SIMS, including the SIMS data model for shellfish growing areas, marinas, and water quality monitoring stations.

<http://205.156.31.24/SIMS/Web/simsfaq.htm>

The Shellfish Information Management System employs emerging Internet and spatial database technologies to integrate, access, visualize, and analyze data through web-based applications. SIMS is designed to:

- Facilitate sharing and dissemination of information within ISSC
- Provide information related to the condition of coastal waters, shellfish growing area classifications and water quality monitoring by state shellfish programs
- Aid the states in defining and mapping growing area classifications and establish links to complementary coastal information nationwide
- Facilitate queries and summaries of shellfish waters at the state, regional and national level

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Center For Coastal Environment Health and BioMolecular Research

Shellfish Information Management System(SIMS)

APPENDIX B. COMMUNICATION WITH SIMS PARTNERS

1. Meetings with state shellfish agencies

* Purpose: Work with state shellfish agencies to better understand how the state shellfish agencies do business and how SIMS might mesh with their data and needs.

* Agenda:

- Demo SIMS. Review the basic capabilities and data layers from states (shellfish areas, water quality monitoring sites, location of marinas).
- Learn about state status regarding GIS software and capabilities, data organization and database access, plans for STORET, and analysis tools used in state shellfish program.
- Discuss the definition and mapping of classified areas and compatibility with SIMS.
- Review IT architecture and data organization with IT/GIS staff.
- Outline methods for streamlining data sharing and accessibility to SIMS tools.

State	Date	Participants
Oregon Dept. of Ag.	September 23, 2004	Laura Kracker, Sachin Agnihotri, Deb Cannon, Deanna, Debbie
Washington Dept. of Health	September 21, 2004	Laura Kracker, Sachin Agnihotri, Don Melvin, Craig (IT) Woolrich, Nancy West
Florida Dept. of Ag.	September 14, 2004	Laura Kracker, Sachin Agnihotri, David Heil, Christopher Brooks, Jackie Harrell
Virginia Dept. of Health	June 22, 2004	Laura Kracker, Sachin Agnihotri, Daniel Powell, Keith Skiles
Delaware Div. of Water Resources	April 29, 2004	Laura Kracker, Sachin Agnihotri, Jack Pingree, Debbie
Maryland Dept. of Env.	April 27-28, 2004	Laura Kracker, Sachin Agnihotri, Kathy Brohawn, John Chucoski, Fred Shenerman
New Jersey DEP Virginia DOH	August 27-28, 2002	Laura Kracker, Ilias Jennane, Mike Kusmiesz, Bob Connell, Daniel Powell
South Carolina DHEC	April 22, 2002	Laura Kracker, Jeannie Eidson

2. SIMS Workshops

SIMS/STORET Technical Workshop.

June 18, 2003 Key West, FL

Held at the Gulf and South Atlantic States Shellfish Conference (GSASSC).

* Purpose: Full day workshop, in coordination with EPA to demonstrate SIMS and the relationship to STORET water quality data.

* Participants: state agency representatives and others attending the GSASSC, including Paul Comar, Malcolm Meaburn, Laura Kracker, Ilias Jennane, and Sachin Agnihotri (CCEHBR), as well as representatives from EPA and FDA.

Complementary SIMS/EPA Databases.

March 13, 2002 Washington, DC

* Purpose: Review existing environmental databases for collaboration between EPA and CCEHBR

* Participants: Bill Kramer, Cary McElhinney, Michael Plastino, James Woodley (EPA); Paul DiStefano (FDA); Paul Comar, Malcolm Meaburn, Laura Kracker (CCEHBR).

SIMS FY2000: User Interests and Database System Planning Workshop.

March 14-15 2000 Atlanta, GA

* Purpose: Two day workshop to demonstrate draft SIMS and solicit input and data from additional states.

* Participants: Brian Pierce (FL); Mike Ordner (TX); Roger Colwell, Joe Jewell (MS); Jeff McCool, Randy Farris (AL); Kathy Brohawn, Melissa Ellwanger (MD); Robert Croonenberghs, Keith Skiles (VA); Stephen Murphy (NC); Debbie Lee Rouse, Jack Pingree (DE); Trumna McDaniel (LA); Joel Hansel (EPA); Laura Kracker, Paul Comar, Paul Bauerfeld, Dan Johnson, and Malcolm Meaburn (CCEHBR).

SIMS: User Interests and Database System Planning Workshop.

February 9-10, 1999 Charleston, SC

* Purpose: Two day workshop intended to assess interest and needs of state shellfish agencies related to a shellfish information management system.

* Participants: Bill Eisele, Bob Connell (NJ); Mike Coker, Charlie Newell, Jeannie Eidson (SC); Brian Pierce (FL); Jennifer Tebaldi, Don Melvin (WA); Paul DiStefano, Marc Glatzer (FDA); Tod Dabolt (EPA); Eric Trembl (NOAA/CSC); Laura Kracker, Paul Comar, Paul Bauerfeld, Al Fortner, Dan Johnson, Lew Lacoss, Malcolm Meaburn and Sandra Sharp (CCEHBR).

3. SIMS Presentations

Comar, P., and L. Kracker. SIMS Shellfish Information Management System. Presented to Interstate Shellfish Sanitation Conference 2003 Biennial Meeting. Portland, OR. August 2-8, 2003.

Comar, P., L. Kracker, M. Meaburn, and V. Boles. SIMS Shellfish Information Management System. Presented to Interstate Shellfish Sanitation Conference Executive Board. Atlanta, GA. July 18, 2002.

Kracker, L., P. Comar, P. Bauersfeld, and M. Meaburn. A Unified Information System for Shellfish Restoration. Poster presentation at Coastal Geotools. Charleston, SC. January 8-11, 2001.

Comar, P., L. Kracker, P. Bauersfeld, and M. Meaburn. A Unified Information System for Shellfish Restoration. Poster presentation at Fourth International Conference on Shellfish Restoration. Hilton Head, SC. November 15-18, 2000.

Kracker, L. and P. Comar. SIMS Shellfish Information Management System. Presented to 51st Interstate Seafood Seminar, Virginia Beach, VA. October 12-15, 1999.

Kracker, L. and M. Meaburn. SIMS Shellfish Information Management System. Presented to EPA Gulf of Mexico Program Planning Meeting. New Orleans, LA. May 1999.

APPENDIX C. USER'S MANUAL

This user's manual includes guidance on:

- I. The SIMS web pages that allow state agencies to add information about their shellfish programs to SIMS.
- II. How to use the SIMS GIS web application. This includes the functions that are built in to assist shellfish managers and basic GIS tools for interactive mapping.
- III. A module designed to assist in the conversion of state data layers to the SIMS data model.
- IV. The general format of shapefiles that state agencies contribute to SIMS.

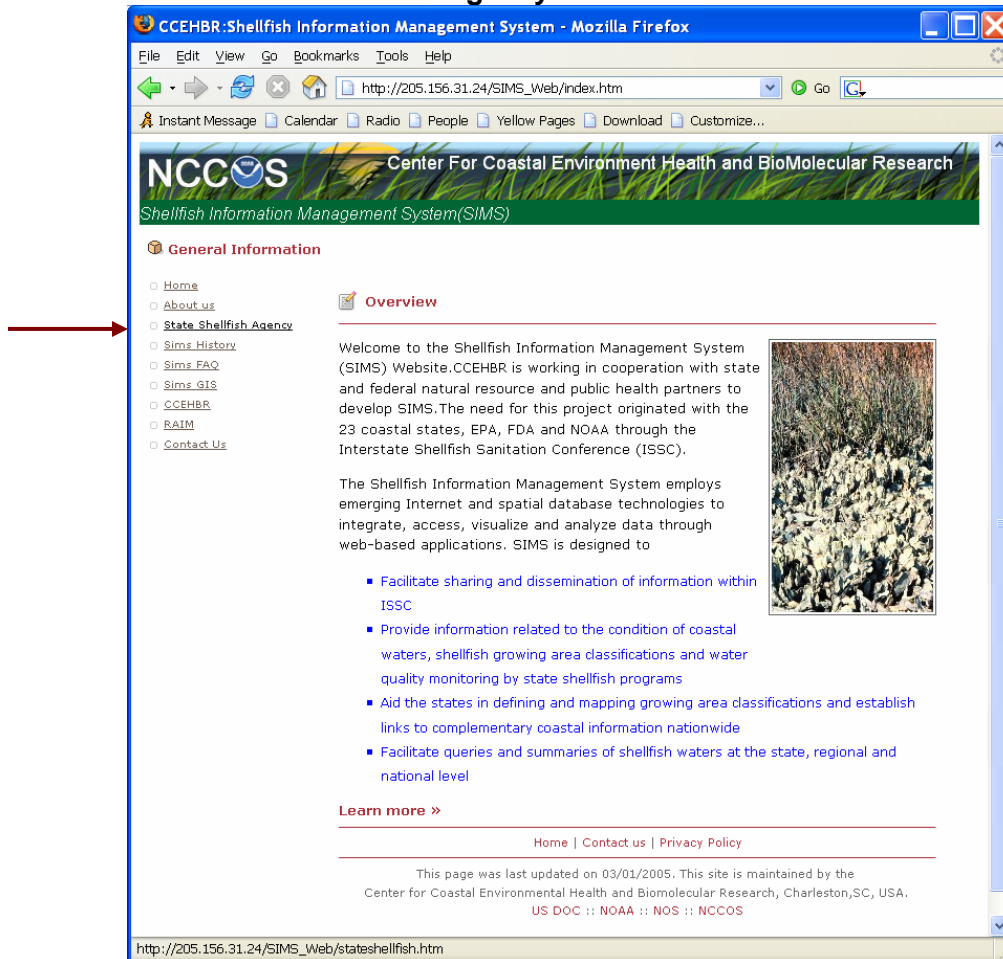
Information on SIMS, state shellfish agencies, and a FAQs page can be found at:
http://205.156.31.24/sims_web

The SIMS GIS application is found at:

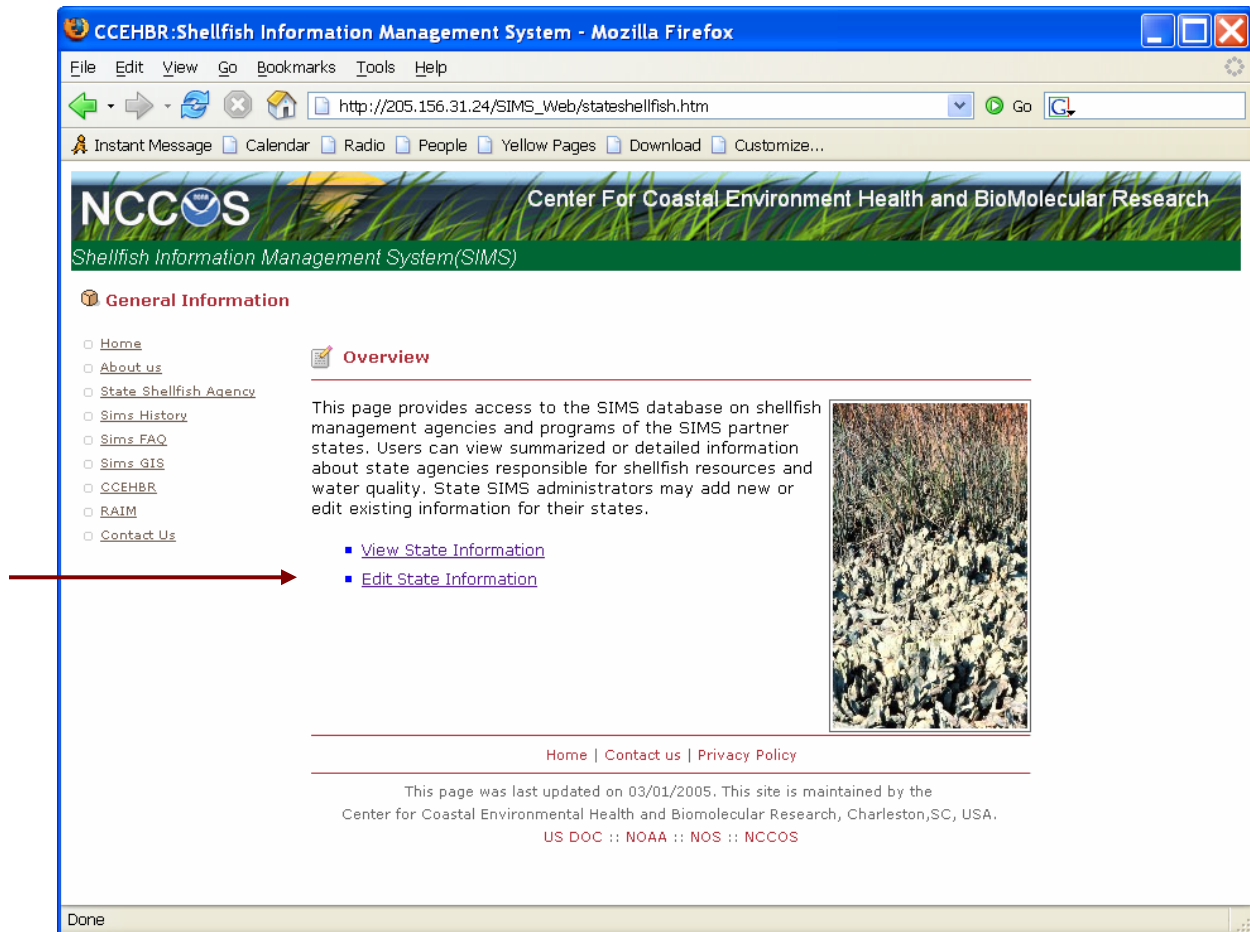
http://205.156.31.24/SIMS/CCEHBR_Viewer/main_frame.aspx

- I. To enter information about state shellfish programs, go to the SIMS web page.
http://205.156.31.24/sims_web

1. Click on the **State Shellfish Agency** link in the left menu.



2. Then click on **Edit State Information**.



3. Enter username and password provided by the SIMS administrator. You will be able to change this once you log in.

 **State Login Page**

Log In

UserName:

Password:

Enter

4. The following interface allows the state agencies to enter a variety of information about their agency. There is a separate page for each category of information that can be added (Personnel, Responsibilities, Analysis Methods, GIS/DB, Resources, Layers, Parent Organization). After information is added to each page, click **Update**. The **Change Password** button leads to an interface where the password can be changed.

ProgramsBis - Mozilla Firefox

File Edit View Go Bookmarks Tools Help

http://205.156.31.24/SIMS_Web/SPI/Programs.:

Instant Message Calendar Radio People Yellow Pages Download Customize...

Shellfish Information Management System

Shellfish Programs Information

State:

Program Name: Nbr of Personnel:

Address:

City: State: Zip:

Division: Department:

Web Address: >>

Mission Statement:

Personnel Responsibilities Analysis Methods GIS/DB Resources Layers Parent Organization

Print Info **Update** Shellfish Programs List Change Password

Done

5. Within each category, to add a new entry, click **Add New**. To edit an existing entry, highlight the name by clicking on >> and then make changes in the boxes below. Remember to click **Update** to submit changes to the database from each page.

The screenshot shows a web browser window titled "Employees - Mozilla Firefox" with the address bar displaying "http://205.156.31.24/SIMS_Web/SPI/Employees.aspx". The page content is titled "Employee Information" and features a table with the following data:

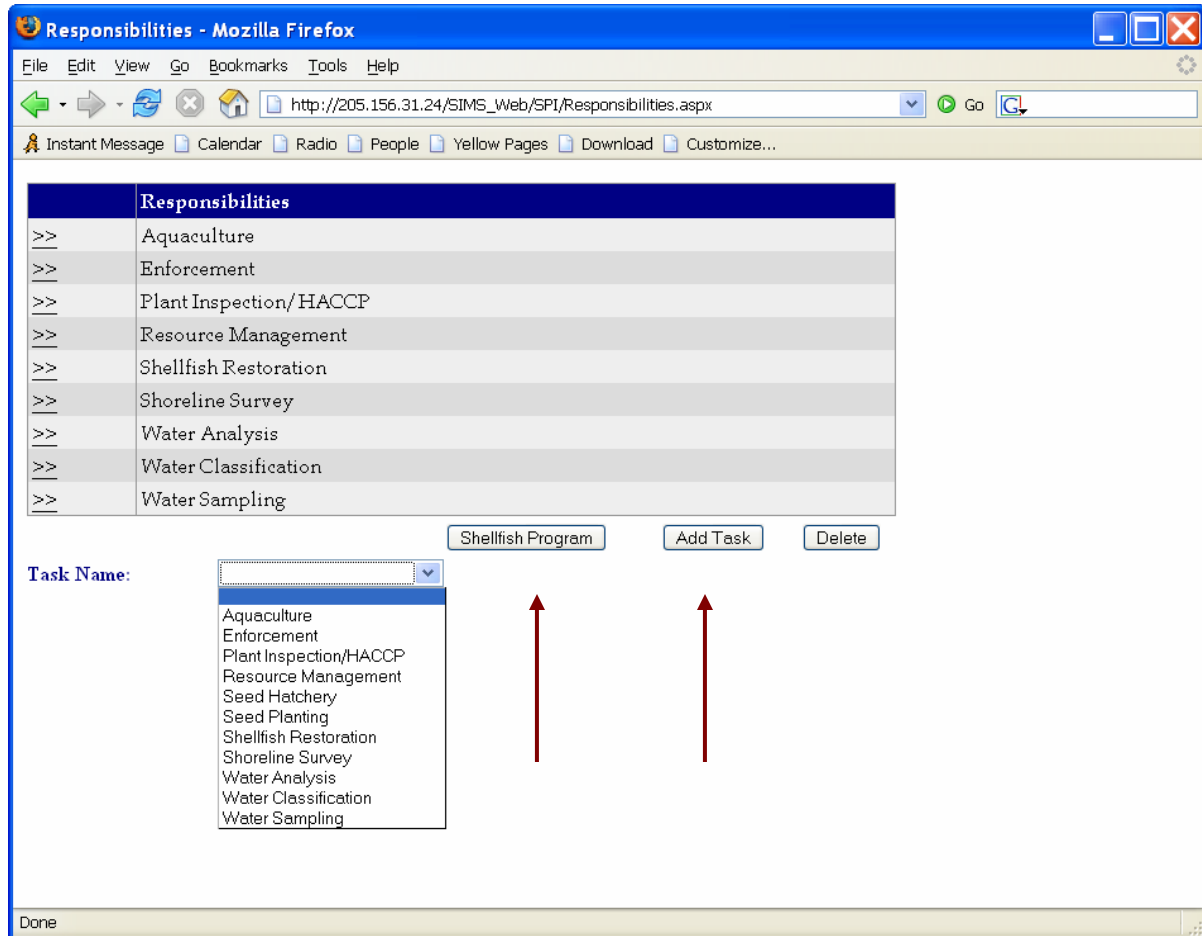
	Title	Name	Phone	Fax	Email
>>	DMR-Marine Fisheries Scientist III	Marty Jones	(228) 374-5000	(228) 374-5220	Send Email
>>	DMR-Bureau Director	Scott Gordon	(228) 374-5000	(228) 374-5220	Send Email
>>	DMR-Marine Fisheries Scientist IV	Dale Diaz	(228) 374-5000	(228) 374-5220	Send Email

Below the table is a form for editing an entry. The form fields are:

- Title:** DMR-Marine Fisheries S
- Name:** Marty Jones
- Phone:** (228) 374-5000
- fax:** (228) 374-5220
- ☐ Is Contact
- Email:** marty.jones@dmr.state.








At the bottom of the form are four buttons: "Shellfish Program", "Add New", "Update", and "Delete". Red arrows point to the ">>" link in the first row of the table, the "Add New" button, and the "Update" button.

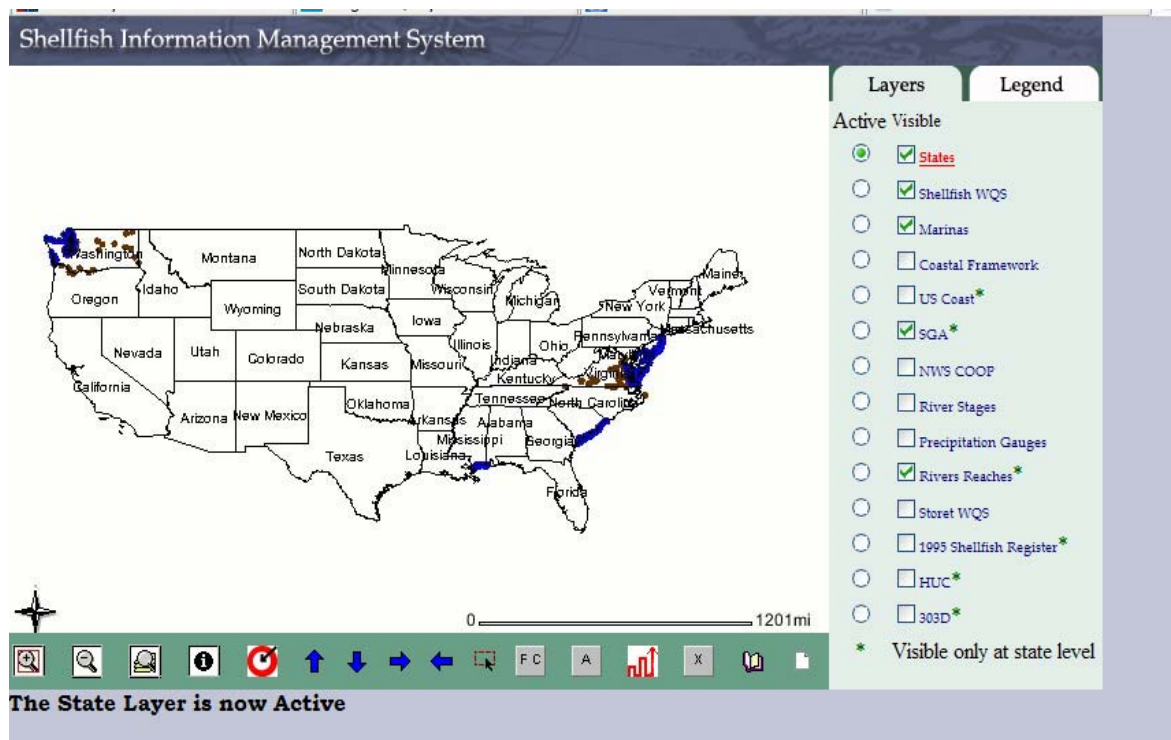
6. Pages that provide many choices or descriptions of activities will have the option of adding items listed in a pull-down menu (new choices can be added to the list as requested by SIMS users). For instance, to describe an agency's Responsibilities, the user can add a responsibility from the list by clicking on **Add Task**. In addition, the **Shellfish Program** button will lead back to the main menu.




II. The GIS web application can be accessed at:
http://205.156.31.24/SIMS/CCEHBR_Viewer/main_frame.aspx

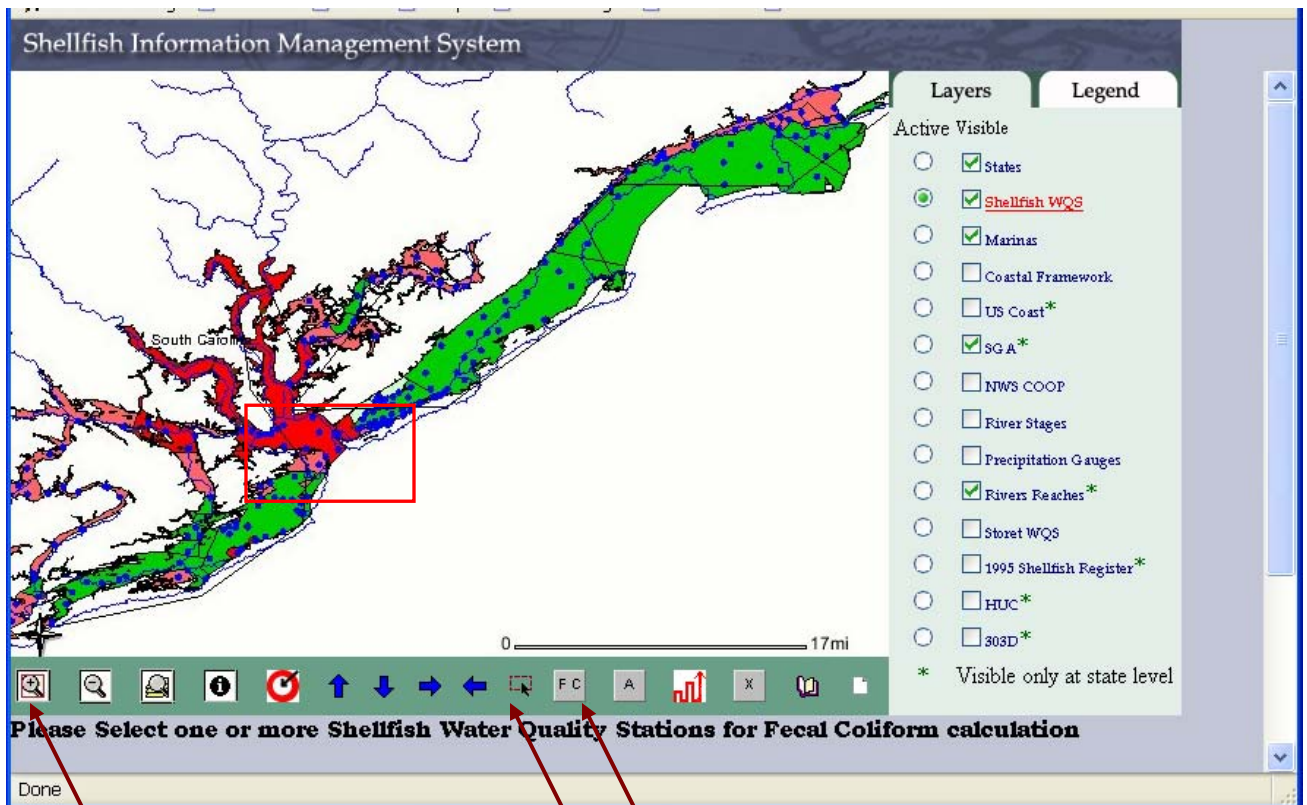
The GIS Web application allows users to map a variety of features related to shellfish waters. The SIMS internet mapping application has typical rendering tools, as well as Help and Metadata buttons. In addition, these tools are available:

-  * Fecal Coliform. Run fecal coliform statistics, when the state water quality stations layer or the Storet water quality stations layer is active and stations are selected with the select tool;
-  * Acreage. Calculate acreage per classification type for an individual state, when the state layer is active;
-  * Trends in Class Acreage. Summarize trends in growing waters classification for an individual state, when the state layer is active;
-  * Extract. Extract a water quality station, shellfish layer, marinas, or shellfish register shapefile for a state, when the respective layer is active;
-  * River Stage and Precipitation Gauges. Activate a URL for near-real time data when the HADs precipitation or river stage layer is active.
-  * Metadata. A link to the metadata for each layer in SIMS.
-  * HELP on navigating the GIS interface.



FC * Fecal Coliform. Run fecal coliform statistics, when the state water quality stations layer or the STORET water quality stations layer is active and stations are selected with the select tool.

1. Zoom to the area of interest.
2. Click on the **FC** button to make the shellfish water quality stations layer active.
3. Select water quality stations by drawing a box with the select  tool.



4. This will return a table listing the selected water quality stations.

The screenshot shows the Shellfish Information Management System interface. A map of the South Carolina coast is displayed, with various water quality stations marked. A red arrow points to the 'Statistics' button next to station 122 in the table below the map.

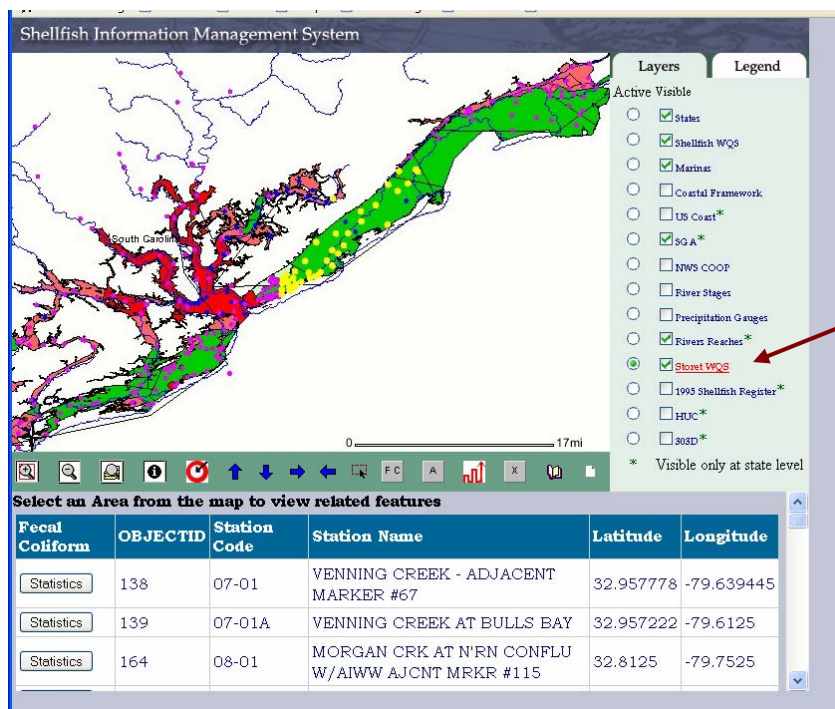
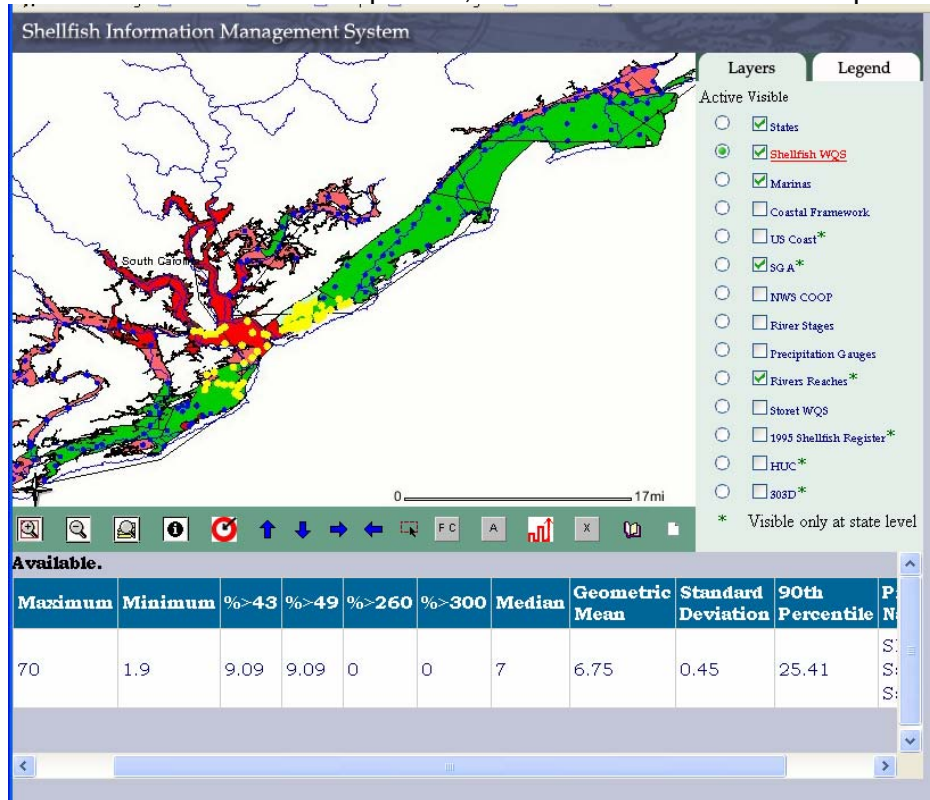
Fecal Coliform	OBJECTID	Station Code	Station Name	Management	Latitude	Longitude	Sampling Plan	Last Sample Date
Statistics	122	10A-32	0	10A	32.701572	-79.89656	SR	
Statistics	123	10A-26	0	10A	32.698358	-79.89883	SR	
Statistics	124	10A-31	0	10A	32.688560	-79.89915	SR	

5. Click on the “Statistics” button next to the desired water quality station.
6. Select the number of samples to include in the calculation.
7. Click the “Run Fecal Coliform Statistics” button.

The screenshot shows the Shellfish Information Management System interface. A map of the South Carolina coast is displayed. Below the map, the 'Number of Samples' dropdown is set to 20, and the 'Run Fecal Coliform Statistics' button is highlighted. Two red arrows point to the dropdown and the button.

Number of Samples: 20 Run Fecal Coliform Statistics

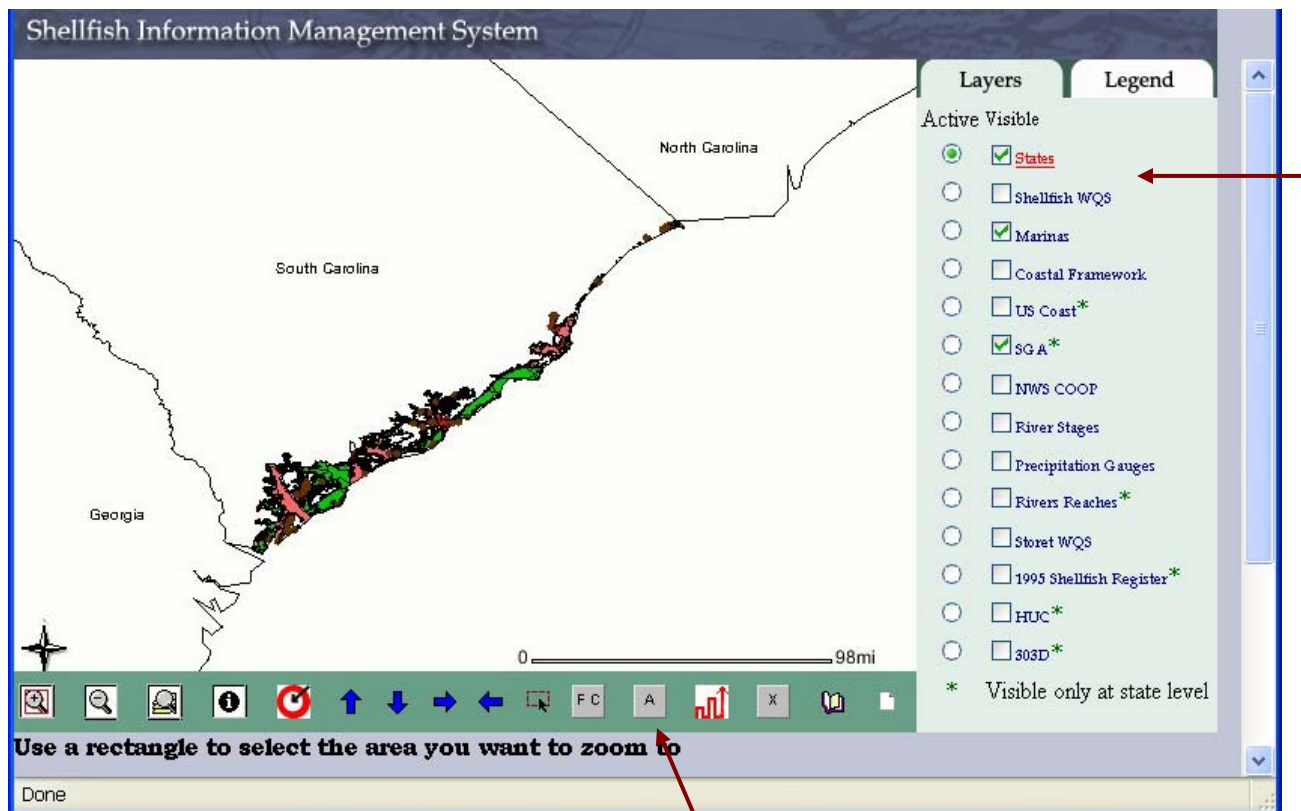
8. A table will be returned giving the sample count, maximum, minimum, %>43, %>49, %>260, %>300, median, geometric mean, standard deviation, 90th percentile, and program name of the agency that collected the data. Note that if fewer samples were used in the calculation than that requested, it will be reflected in the Sample Count field.



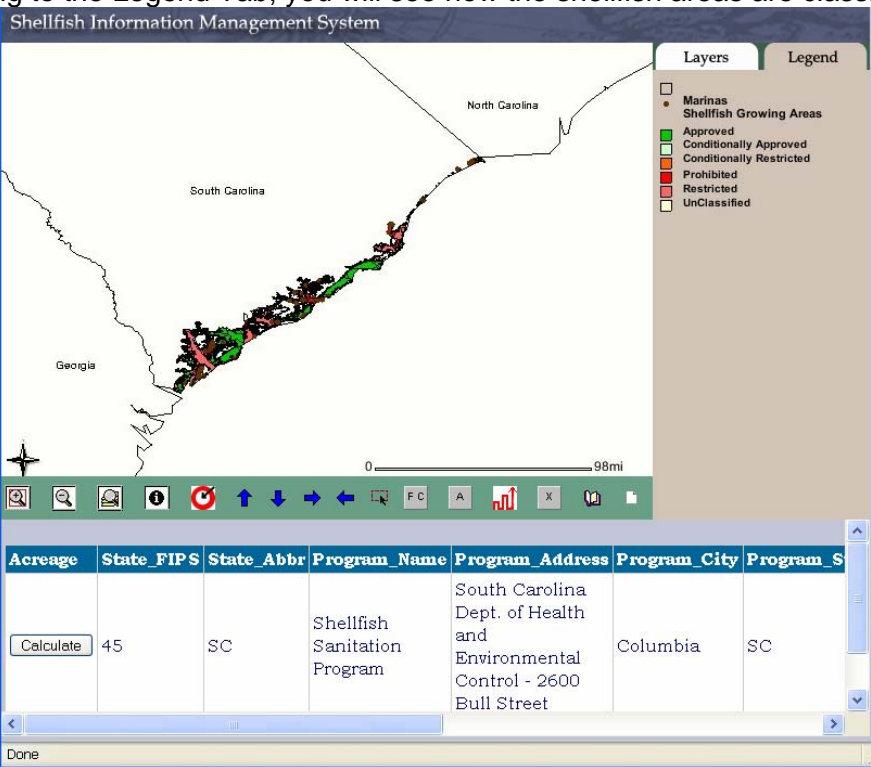
Note that if you make the STORET WQS layer active and select stations from that layer, the same statistics tool will appear as above and will use the data supplied via a query to the STORET database.

A To calculate acreage per classification type for an individual state, zoom into a region, click the Acreage button, and then click on a state.

1. Zoom to the desired area.
2. Click on the Acreage **A** button.
3. This will make the States layer active.

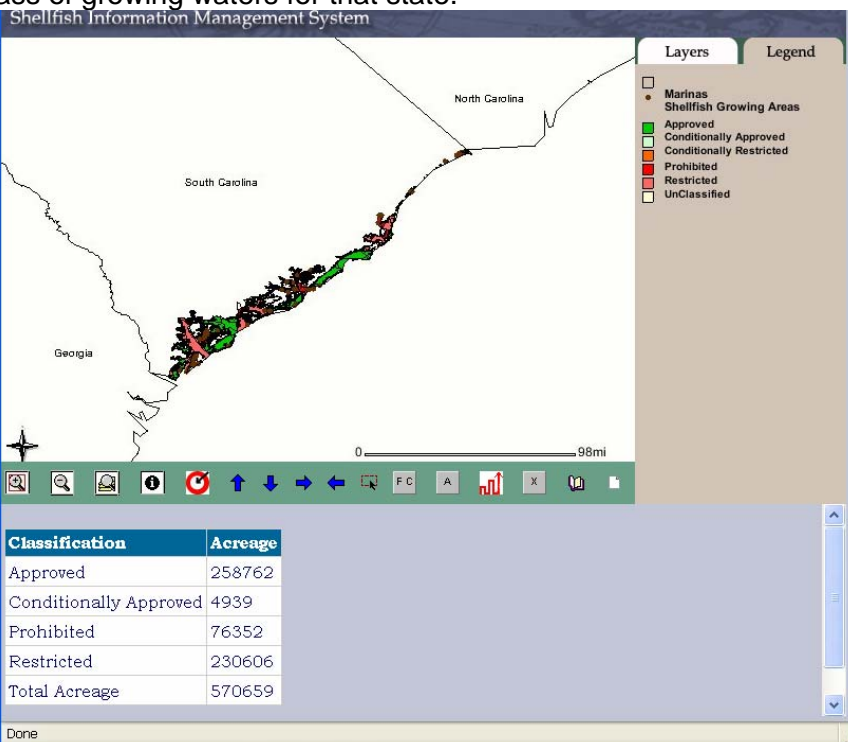


4. Click on the state for which you want to calculate acreage. This will report general information about the state shellfish program and display the calculate button. By switching to the Legend Tab, you will see how the shellfish areas are classified.



Acreage	State_FIPS	State_Abbr	Program_Name	Program_Address	Program_City	Program_S
Calculate	45	SC	Shellfish Sanitation Program	South Carolina Dept. of Health and Environmental Control - 2600 Bull Street	Columbia	SC

5. Click on the “Calculate” button. This will return a table with the acreage reported for each class of growing waters for that state.



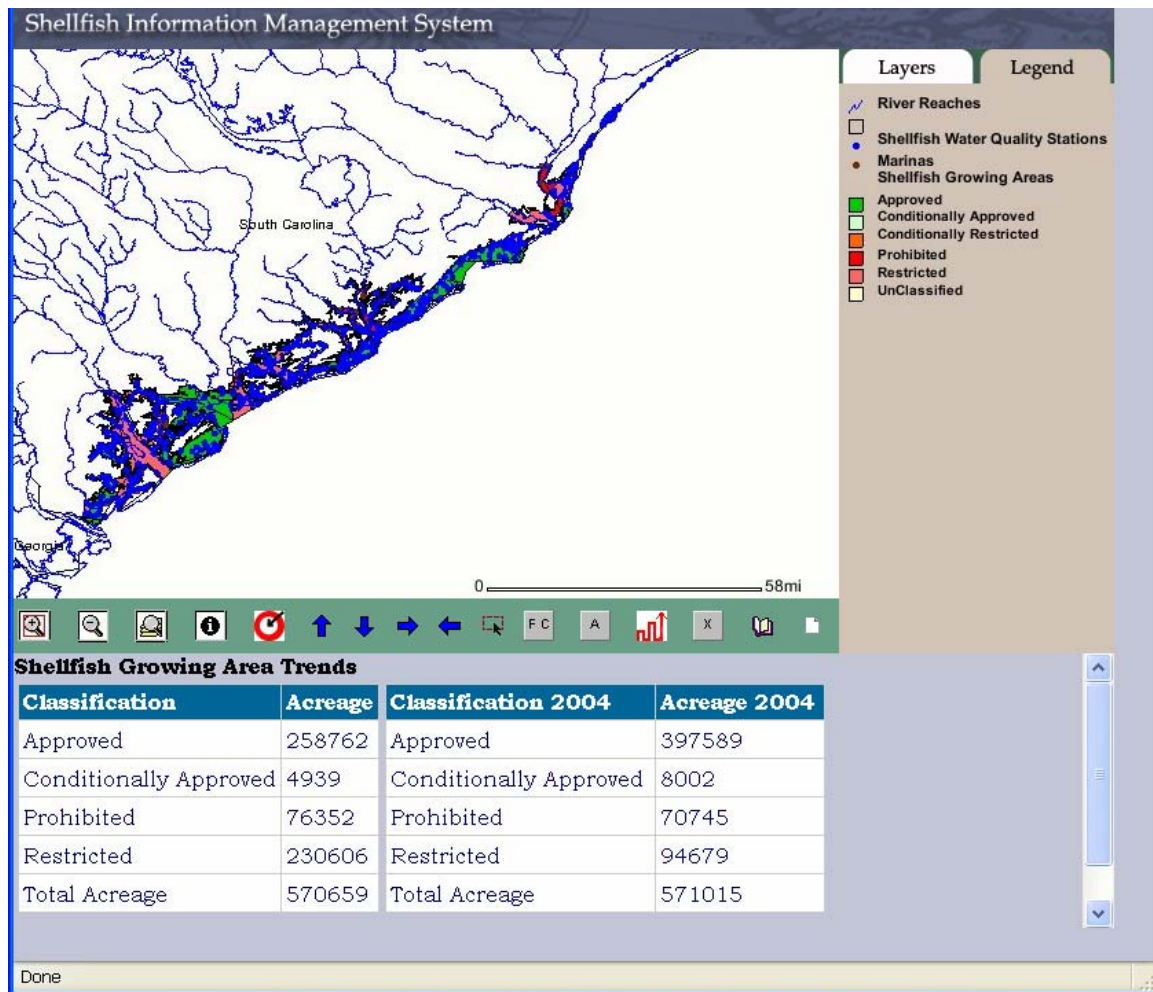
Classification	Acreage
Approved	258762
Conditionally Approved	4939
Prohibited	76352
Restricted	230606
Total Acreage	570659



* Trends in Class Acreage. Summarize trends in growing waters classification for an individual state, when the state layer is active.

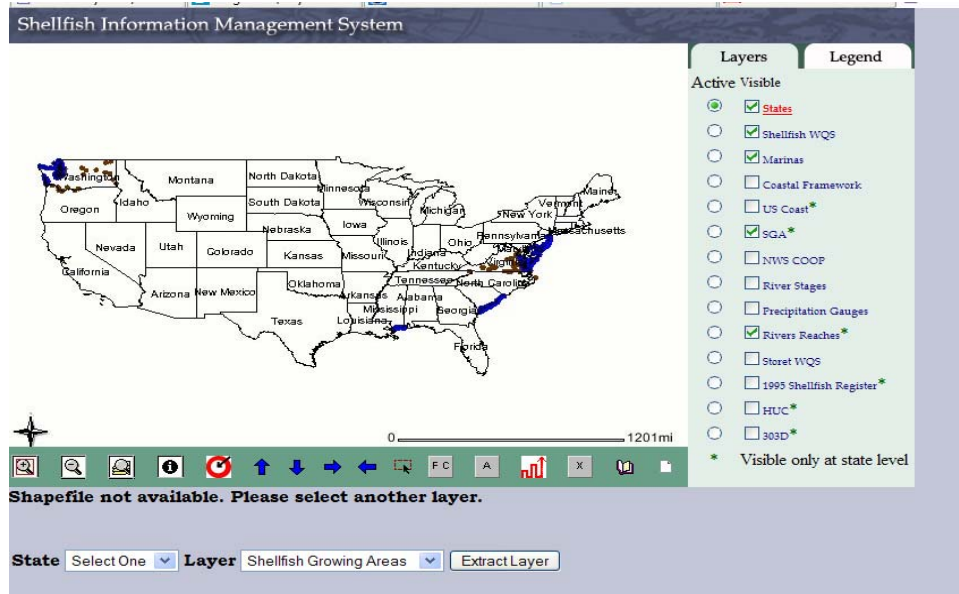
To examine trends or changes in the amount of growing area by class from year to year:

1. Click on the Trend Button which will make the state layer active.
2. Click on the state for which you want to calculate trends.
3. Click on the calculate button which will return acreage by classification type for previous years and for 2004. Future updates to SIMS will allow for this comparison over several years as these data become available.

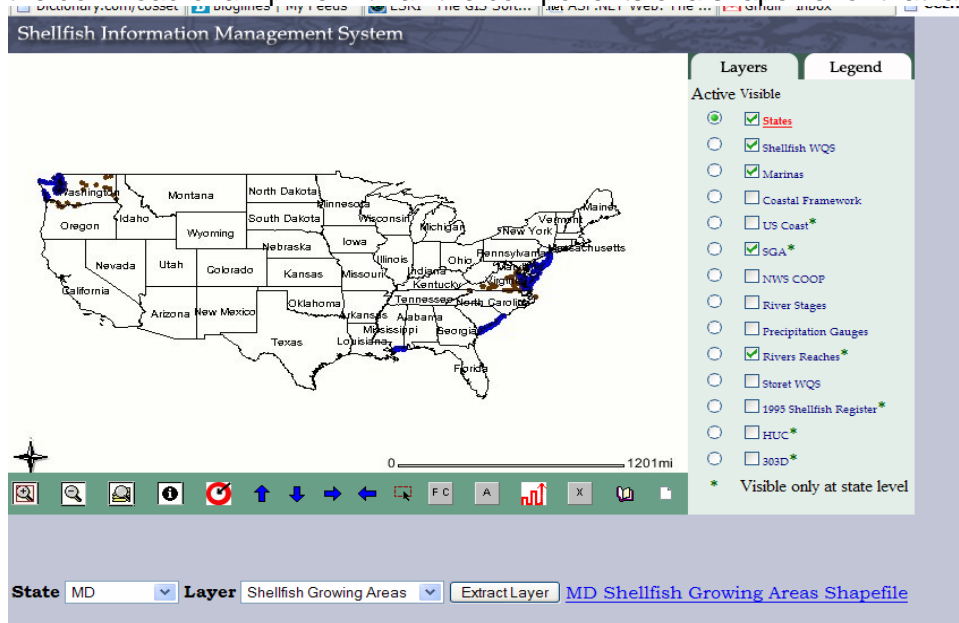


X * Extract. Extract a water quality station, shellfish layer, marinas, or shellfish register shapefile for a state, when the respective layer is active;

1. Click on the extract **X** button.




2. Select a state and the layer that you would like to download as a shapefile.
3. Click the Extract Layer button. A link to the shapefile is returned. Clicking on this link begins the download of a zip file with all the components of a shapefile for that layer.

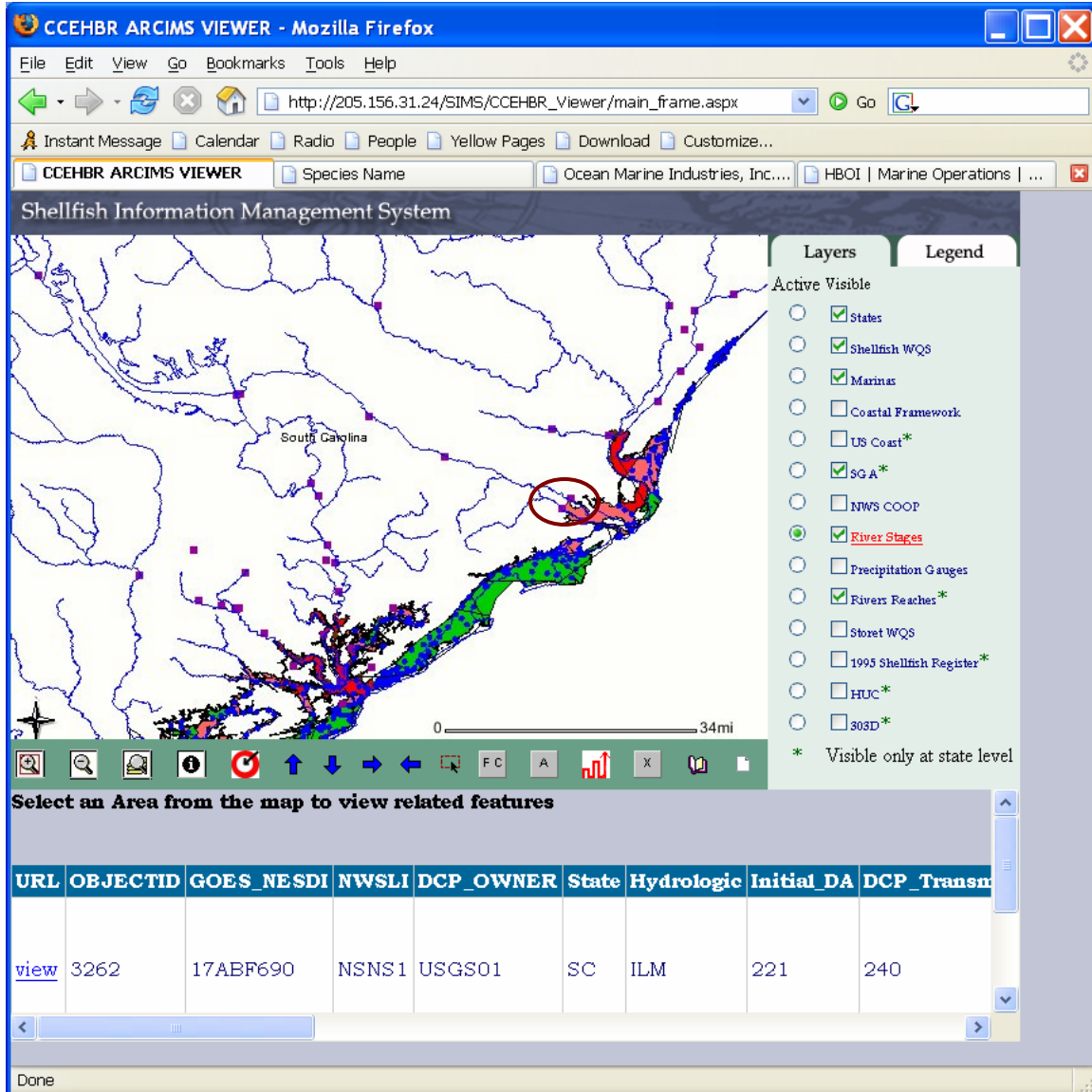


Please refer to the metadata for that layer by clicking the metadata button.



* River Stage and Precipitation Gauges. Activate a URL for near-real time data when the HADs precipitation or river stage layer is active.

1. Zoom to the area of interest.
2. Make either the River Stage or Precipitation Gauges layer active and visible.
3. Use the identity  button to click on the gauge of interest.



Layers

Active Visible

- ☒ States
- ☒ Shellfish WQS
- ☒ Marinas
- ☐ Coastal Framework
- ☐ US Coast*
- ☒ SGA*
- ☐ NWS COOP
- ☒ River Stages
- ☐ Precipitation Gauges
- ☒ Rivers Reaches*
- ☐ Storet WQS
- ☐ 1993 Shellfish Register*
- ☐ HUC*
- ☐ 303D*

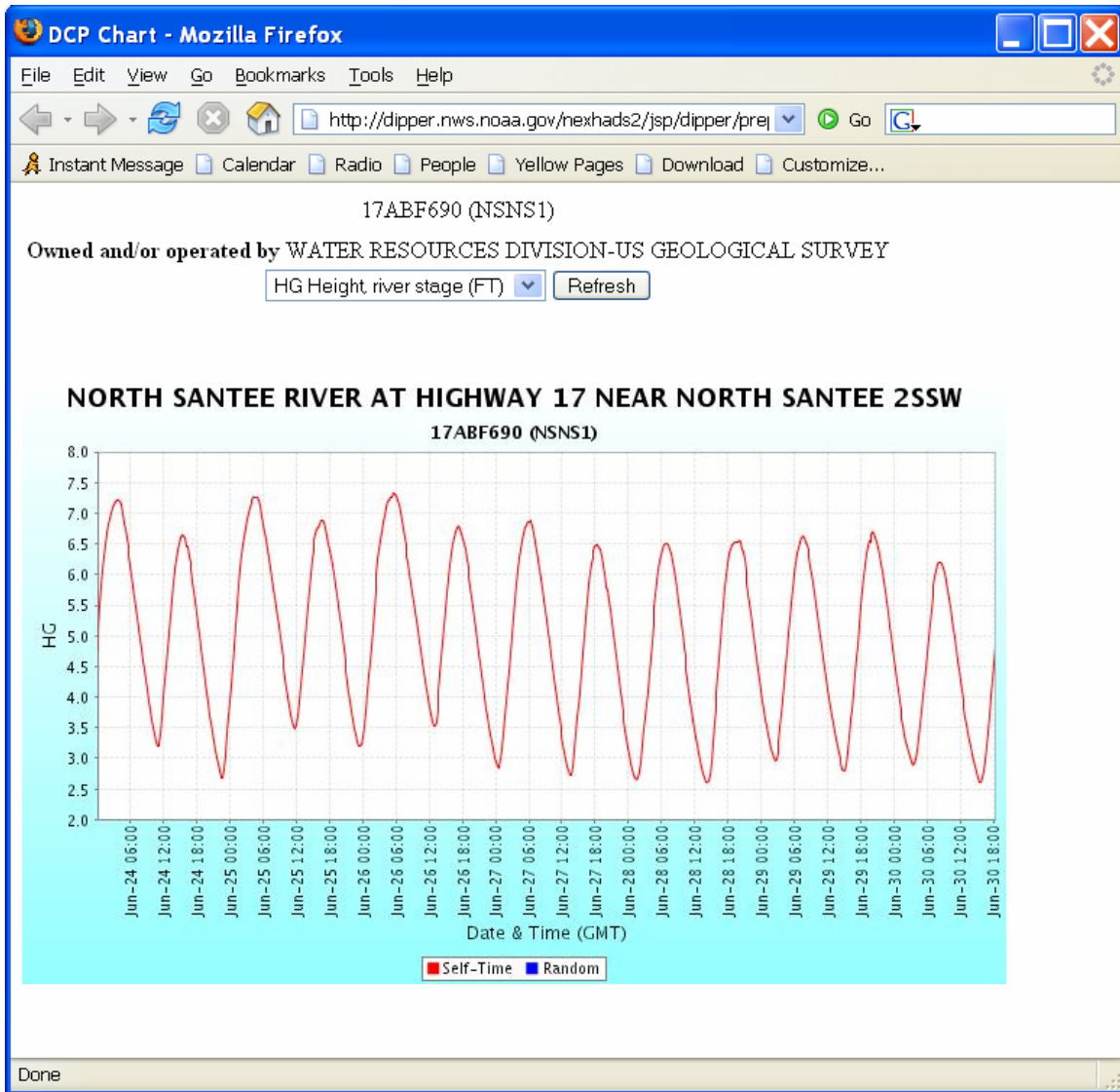
* Visible only at state level


Select an Area from the map to view related features














URL	OBJECTID	GOES_NESDI	NWSLI	DCP_OWNER	State	Hydrologic	Initial_DA	DCP_Transm
view	3262	17ABF690	NSNS1	USGS01	SC	ILM	221	240

4. Click on View in the URL field.

5. Your default web browser will open and provide data on the gauge associated with that location. This data is collected every 15 minutes at the gauge and downloaded every four hours to the National Weather Service server.



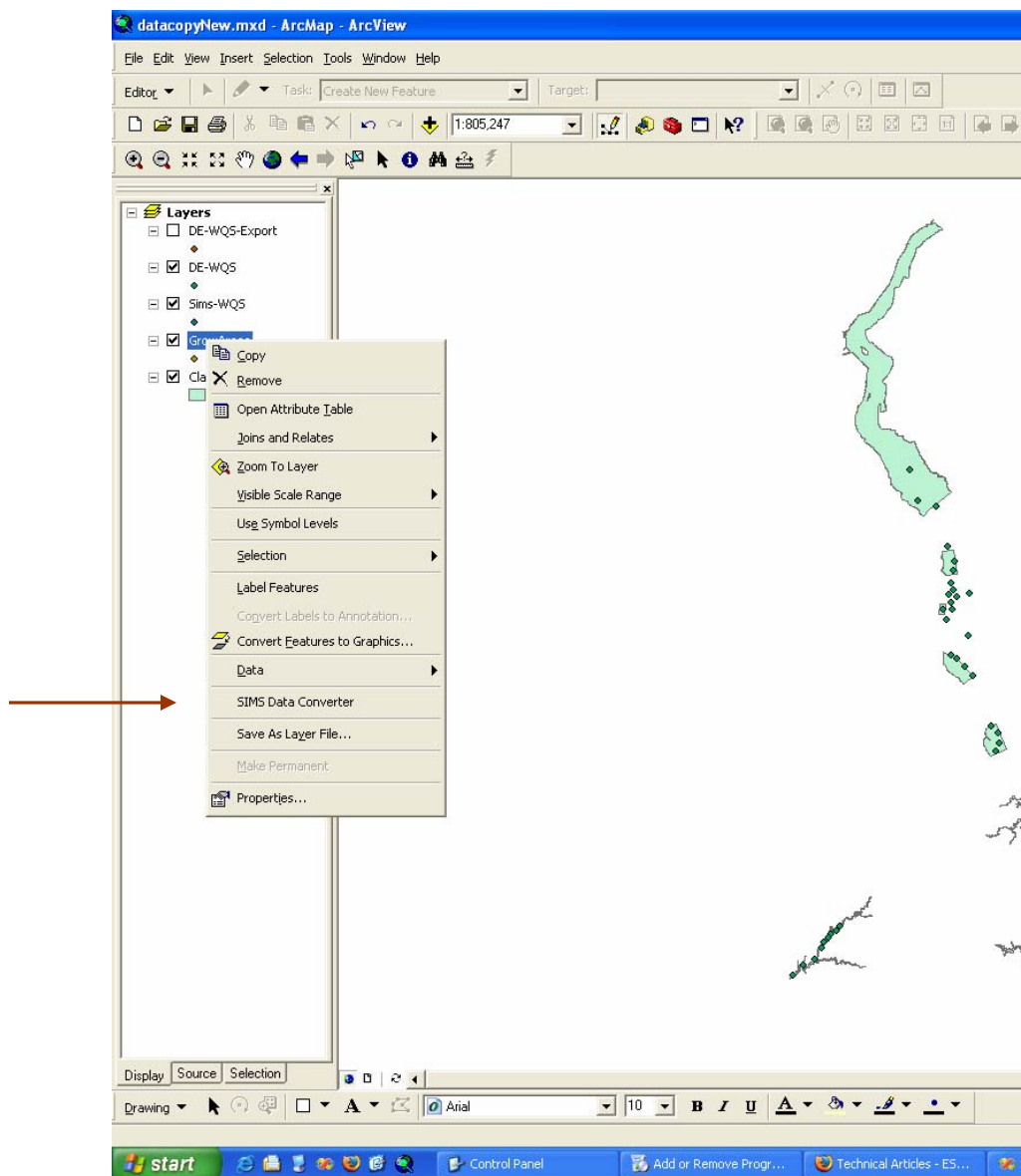
 The HELP button provides additional information on how to use the basic GIS tools for interactive mapping.

	Zoom Box	Click the map and drag a rectangle to zoom into area of interest.
	Zoom Out	Click the map to zoom out.
	Full Extent	Zooms to full extent of the map
	Identify	<ol style="list-style-type: none"> 1. Make active the desired layer from the layers tab. 2. Click the Identify tool 3. Click on the map to obtain information for the point of interest. 4. The result will be displayed in a table <p><u>Note:</u> For point features, zoom in to 5-10 mile range to get accurate results.</p>
	Re-center	Click on the map to re-center.
	Pan North	Moves the map to north
	Pan South	Moves the map to south
	Pan East	Moves the map to east
	Pan West	Moves the map to west
	Select	<ol style="list-style-type: none"> 1. Make active the desired layer from the layers tab. 2. Click the  button 3. Select features by dragging a rectangle around the area of interest. 4. Selected features will be highlighted on the map as well as returned in table format.
	Metadata	Brings up a list of all data layers that are available. Read a brief description of the data layer and link to the metadata.
	Help	Opens the help document.

III. Shapefile conversion utility

Spatial data sent by the state shellfish agencies may not always match the SIMS data model. Therefore a utility has been built to allow the SIMS manager to make decisions on how the state layer relates to the SIMS model. This utility can also be provided to the state participants so they can make decisions on how they want to modify their data layers to fit the SIMS data model. The comparison of a state layer with the SIMS data model requires that the three base SIMS data layers and the associated SIMS metadata files be accessible from the local computer. These files should be placed in a folder named C:\simsdata

1. Add the state layer to an ArcMap project window. **File → Add Data**
2. Right click on layer and select the menu item **SIMS Data Converter**



3. In pop-up window, select State and Target Layer. By default, the field mapping window in the lower right is populated with the suggested field mapping as described in the SIMS metadata. For each source field listed in the source field pull down menu, add a target field from the target fields pull down menu. Click on **Continue** between each field added. When all relevant field names have been mapped, click on **Convert Now**

The Sims Data Converter dialog box is shown. It has a blue title bar with the text 'Sims Data Converter'. The main area is light beige. At the top left, there are two dropdown menus: 'Source Fields' with 'SHAPE_Area' selected and 'Target Fields' with 'Area1' selected. To the right of these is a 'Select a State' dropdown menu with 'Delaware' selected. Below the 'Source Fields' dropdown is a section titled 'Your selected Fields' containing a text box with the following text: 'ProtLevel-->CLASSIFIC1' and 'SHAPE_Area-->Area1'. To the right of this is a 'Select Target Layer' section with three radio buttons: 'Marinas', 'Water Quality Stations', and 'Shellfish Growing Area', with the last one selected. Below these sections are three buttons: 'Continue', 'Convert Now', and 'Exit'. At the bottom right is a section titled 'Field Mapping of Delaware' containing a text box with the following text: 'STATE:Delaware', 'PROT_LEVEL=CLASSIFIC1', and 'SHAPE_AREA=AREA1'.

4. Save the processed shapefile and examine the number of features processed

The first dialog box is titled 'Save as' and has a text box with the text 'SIMSGrowAreas'. It has 'OK' and 'Cancel' buttons. The second dialog box is titled 'Your Files are saved in C:\SIMSDATA\' and has the text 'Total features processed: 111' and an 'OK' button.

The converted state shapefile is now ready to be loaded into the SIMS database using ESRI ArcCatalog.

IV. Guidelines for SIMS spatial data layers.

Guidelines for SIMS GIS data layers									
Marinas.dbf									
DBField names	objectid	fips_state	management	marina_cod	marina_nam	latitude	longitude	number_of_	
Common Field names	shape	state abbreviation	management area	marina code	marina name	latitude	longitude	number of slips	
Definition	Point-ArcGIS internal field	FIPS state code	State shellfish management area	Unique state-assigned marina code	State-assigned name	Latitude	Longitude	Number of boat slips	
Format (units)	NA	varchar	varchar	varchar	varchar	decimal degrees	decimal degrees	integer	
Water_Quality_Stations.dbf									
DBField names	objectid	fips_state	station_co	station_na	management	latitude	longitude	sampling_p	pollution
Common Field names	shape	state abbreviation	station code	station name	management area	latitude	longitude	sampling plan	pollution source
Definition	Point-ArcGIS internal field	FIPS state code	Unique state-assigned station code	State-assigned station name	State shellfish management area	Latitude	Longitude	Type of sampling plan	Major pollution source
Format (units)	NA	varchar	varchar	varchar	varchar	decimal degrees	decimal degrees	char (APC or SR)	char (point source, non-point source, upstream)
Shellfish_Classification.dbf									
DBField names	objectid	fips_state	growing_a1	growing_a2	descriptio	management	classific1	class_basi	classific2
Common Field names	shape	state abbreviation	state growing area code	state growing area name	description	management area	classification	classification n basis	date of classification
Definition	Polygon - ArcGIS internal field	FIPS state code	Unique state assigned ID	State-assigned growing area name	Growing area description	Agency assigned management area	Growing area classification	Reason for clasification	Date classification became effective
Format (units)	NA	varchar	varchar	varchar	varchar	varchar	char (A, CA, CR, R, P, U)	char (water quality, administrative, no survey, conservation)	date
				last_shore	restorati1	restorati2	noaa_chart	noaa_caf_c	usgs_hydro
				last shoreline survey	restoration potential	restoration project	noaa chart number	coastal assessment framework code	USGS 14 HUC code
				Date of last shoreline survey	potential for restoration	shellfish restoration site?	associated NOAA chart number	associated coastal assessment framework code	associated USGS 14 digit hydrologic unit
				date	char (high, med, low)	char (Y/N)	varchar	varchar	varchar

APPENDIX D. METADATA

Metadata for the three layers in SIMS (Shellfish Growing Waters, Marinas, and Water Quality Stations) generated by the state shellfish agencies is available through the SIMS GIS Web application and through these links:

Shellfish Growing Areas:

<http://205.156.31.24/metadata/shellfish-metadata.htm>

Marinas:

<http://205.156.31.24/metadata/marinas-metadata.htm>

Water Quality Stations:

<http://205.156.31.24/metadata/wqs-metadata.htm>

Likewise, metadata for 'framework' spatial data used in SIMS can be found through the SIMS GIS application with additional references listed below:

Hydrologic Unit Code:

<http://water.usgs.gov/GIS/metadata/usgswrd/XML/huc250k.xml>

Hydrometeorological Automated Data System (HADS) for near real time river stage and flow data:

<http://nws.noaa.gov/oh/hads/>

<http://nws.noaa.gov/oh/hads/WhatIsHADS.html>

EPA River Reaches:

http://www.epa.gov/nsdi/projects/rf1_meta.html

<http://www.epa.gov/waters/doc/rfindex.html>

EPA 303(d) Listed waters:

<http://www.epa.gov/waters/data/linear303d.pdf>

Coastal Assessment Framework:

http://spo.nos.noaa.gov/projects/cads/fqdc_metadata/caf_fqdc.html

http://spo.nos.noaa.gov/projects/cads/ftp_gis_download.html

1995 National Shellfish Register – Shellfish Growing waters:

http://spo.nos.noaa.gov/projects/cads/fqdc_metadata/shellfish_fqdc.html

NOAA's Medium Resolution Coastline:

http://spo.nos.noaa.gov/projects/cads/fqdc_metadata/medium_shoreline_metadata_d.html

Storet Water Quality Stations:

http://oaspub.epa.gov/storpubl/DW_resultcriteria_geo

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