

Maine Molluscan Shellfish Resource Mapping Project,
Using Geographical Information System (GIS)

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Introduction

The lack of Maine's marine-related data was described in the 2007 final report of the Bay Management Study, Managing Maine's Nearshore Coastal Resources, which was submitted to the Joint Standing Committee on Marine Resources during the 123rd legislative session. Findings in the report include:

There are many types of nearshore data that do not exist, as well as many existing data sources that are out-dated or at the wrong scale to be useful. Available nearshore data area scattered in topic and geographic area of focus. (p. 28)

Marine Geographic Information Systems (GIS) in Maine are limited in their ability to facilitate understanding and decision-making regarding nearshore environments. GIS data acquisition in Maine has been dominated by land-side data and issues. There has been no concerted effort on the part of marine-focused organizations to create a more comprehensive marine GIS. (p. 28)

It is extremely difficult to locate and gather existing nearshore data. State and federal government websites are generally inadequate in making data available. Non-governmental organizations are scattered, and some lack capacity to make their data easily available. In addition, all entities may be reluctant to share data for a variety of reasons, including: desire for ownership or credit; concern that data might be misused or misinterpreted; belief that data is confidential or sensitive; or knowledge that data collection or analysis is still in progress. (p. 28)

The need for shellfish distribution data became apparent when the Biotxin Monitoring program at the Maine Department of Marine Resources (MDMR) was not able to access current and comprehensive data on shellfish resources, in order to minimize economic losses due to red tide-related shellfish closures. The MDMR Growing Area Classification Program had no comprehensive information on shellfish locations, and therefore was unable to prioritize harvest areas for increased water sampling, pollution remediation, and shoreline surveys. The Maine Department of Inland Fish & Wildlife and the Maine Oil Spill Contingency Plan did not have access to recent shellfish location data to use in their project maps. Coastal towns vary in their personnel and technical resources, which can affect their ability to assess town shellfish resources. As a result, town planning committees may not have current shellfish information to consider when coastal projects are proposed.

Project Objectives

This project was begun in January 2008, when the Biotxin and Growing Area Classification programs desired a comprehensive collection of state shellfish resources to assist with program activities. The project manager was asked to gather coastal Maine molluscan shellfish distribution information. The manager encouraged local harvesters and municipal shellfish committees to contribute distribution information observed within the last 2-3 years, so data could be obtained from people with "hands-on" knowledge whenever possible. The following eight species were considered for this project: softshell clam (*Mya arenaria*), blue mussel

(*Mytilus edulis*), European oyster (*Ostrea edulis*), American oyster (*Crassostrea virginica*), hard clam -also called quahog (*Mercenaria mercenaria*), atlantic surf clam (*Spisula solidissima*), razor clam (*Ensis directus*) and sea scallop (*Placopectin magellanicus*).

Although the data gathered for this project is qualitative in nature and has not been field-verified, it provides general information on state shellfish locations; and is baseline information on which future studies of shellfish densities and distributions could be based. Some sea scallop locations were obtained by plotting 2005 – 2007 MDMR sea scallop tow survey information; this has been noted in the sea scallop attribute table. Additional information was obtained from MDMR staff and helpful members of the public who knew locations of shellfish resources.

Review of Existing Shellfish Shapefiles

The project manager investigated existing MDMR shellfish shapefiles, as well as shellfish files available from the Maine Office of GIS (MEGIS), to see if there were similarities with the current project's data. Metadata from the MDMR files were checked for information on May 1, 2009, and the online abstracts for the MEGIS files were reviewed on May 5, 2009.

The MDMR has a shapefile titled "Clams2000", and the metadata indicate this is a file showing "Maine towns with soft clam management, 2000". There is no named individual responsible for the data collection, and no date of when the data set was made available for release. This shapefile's data would not be comparable to the current project, because they show towns that had municipal shellfish ordinances in (presumably) the year 2000.

Another MDMR shapefile is titled "shell", which is the "shell" file also available through the MEGIS website. The metadata says the shapefile is a "generalized representation of molluscan shellfish habitat in Maine, based on a 1977 Maine Department of Marine Resources coastwide survey". The metadata says the polygons were "digitized from paper maps produced for the US Fish and wildlife Service (USF&WS) "Ecological Characteristics of Coastal Maine"". The contact person is Seth Barker at the MDMR, and the time period is October 1, 1980. The attribute table is coded by species. This layer was based on the best available knowledge at the time, so there is some correlation between this layer's data and the current project.

A third MDMR shapefile is named "softclams", which shows softshell clam habitat in Casco Bay. This information was compiled by MER, Brunswick Maine and digitized by MDMR staff. This layer mapped habitat, rather than the presence of softshell clams, so there is correlation between this layer's data and the current project's softshell clam data but they may not be in complete agreement.

Another MDMR shape file called "SEED" is also available from the MEGIS website. It shows "point and polygon locations of Maine mussel seed conservation areas". The data for this coverage were "screen digitized on a 1:24000 scale base using descriptions contained in Maine Department of Marine Resource (MDMR) rules". The contact person is Seth Barker at the MDMR, and the date is January 1, 1995. The data for this file was created by using boundaries described in rules, which is a very different method of obtaining data than the methods used in

this project. The project's blue mussel shapefile doesn't indicate if a mussel polygon contains seed or market-size mussels; it simply indicates a legally defined area.

A MDMR shape file called "ocean_quahog" is described as "PSP sampling stations for Ocean Quahogs". There is no time period or contact person listed in the metadata. The date of the metadata is June 8, 2004. The project's shapefile describes sampling locations rather than distribution information, so is not sufficiently complete for describing ocean quahog distributions.

Methods

The project was conducted using the ArcGIS 9.2 program. Raster navigational National Oceanic and Atmospheric Administration (NOAA) charts were used, along with the Maine town layers called "towns-24k" and "metwp24", to create sets of coastal town basemaps on which respondents could compile shellfish resource polygons. The maps were as "zoomed in" to the coastline as possible, without making too many maps for one town. Landmarks (coves, peninsulas) were used as reference points from one map to the next, so participants could stay oriented throughout the map sets.

Map sets were initially sent to municipalities with shellfish ordinances, and the MDMR's Area Biologists were alerted that maps would be sent to the Chairmen of the shellfish committees. This was done because towns with shellfish ordinances have regular contact with the Area Biologists, who could help the committees compile shellfish resource polygons on the maps or answer basic questions about the project. If a committee had in-depth questions about the project, the biologist could provide the committee with the project manager's contact information. A cover letter was added to the map sets, which provided background information and asked the committee for assistance; it also stated that the information would be publicly available at the end of the project. A list of the shellfish species to be mapped was placed on the back of the cover letter. The beginning of the project coincided with the time of year in which shellfish committee leadership roles often changed. Therefore, map sets were sent to the Town Clerk's office, with a note asking the clerk to forward the maps to the chairman of the shellfish committee. Asking the Town Clerk to forward the maps minimized the likelihood of the project manager to send maps to the wrong person.

The project manager expanded efforts to contact knowledgeable people outside of the municipal shellfish committees. Flyers explaining the purpose of the project, and the manager's contact information, were placed at the MDMR Licensing window at the Hallowell office. Email notifications were sent to four email distribution lists maintained by the Public Health Division, which included: aquaculturists, legislators, certified shellfish dealers, industry cooperatives, state personnel, and a general list for interested people. Cover letters and maps were mailed or emailed to selectmen or harbormasters of towns without shellfish ordinances. If a town with a shellfish ordinance had not returned maps within a few months, the selectmen and the harbormasters for those towns were also contacted to ensure that multiple people within a town were notified of the project. A letter was sent to an industry association, asking for assistance from their harvester members. Project information was provided to the public at the MDMR Maine Fishermen's Forum booth during March 5-7, 2009. The project manager used MDMR

aquaculture lease contact information to selectively call some lease holders located in regions that didn't respond to initial requests for assistance, and which had no wild shellfish data in the project's shapefiles. Several harvesters contacted the project manager and offered to mark large-scale areas of shellfish resources. Selected NOAA charts were mailed to these harvesters and a postage-paid return envelope was included, to minimize harvester expense. Maps of selected towns were sent to the MDMR Area Biologists, to capture their knowledge of local shellfish resources.

People were asked to mark shellfish resources by outlining areas on the maps where species were observed within the past two to three years, so the compiled data would show a "snapshot in time" of where shellfish were located. Participants could write in the names of the species, or use a different pen color for each species. Several people called the project manager and asked if all shellfish locations should be marked, or just those with commercial potential. The manager encouraged all locations to be marked. Several towns chose to mark only commercially harvestable locations, and some chose to mark only commercial species.

Marked maps were scanned into Adobe Acrobat 6.0 Professional, and a .PDF document was created. The .PDF documents were georeferenced to the appropriate raster navigational NOAA chart, and polygons were created to encompass each marked location of molluscan shellfish. Where multiple sources indicated a specific location, the most "hands-on" source category was used as the source. Some polygons are composites from several sources, and show the largest boundary indicated by the multiple sources.

Many sea scallop locations were provided by harvesters, but the project manager wanted to capture recent MDMR sea scallop tow survey information as well. The scallop tow survey data for years 2005 to 2007 were extracted from the Department's MARVIN database, and placed into a Microsoft Excel spreadsheet. This spreadsheet was converted into an Access database file, and imported into the GIS project file. The X-Y coordinates were plotted in ArcMap, using geographic coordinate system "North American Datum 1983". Polygons were drawn around points containing reported quantities of at least one scallop. There were two points in the 2005 sea scallop data that were located over a land mass: they also contained reported quantities of zero scallops, and they were excluded from the sea scallop shapefile. There were two points in the 2006 sea scallop data that were south of Mount Desert Island; since there was no reference town in the "towns-24k" file to correspond to these points, they were excluded from the sea scallop shapefile.

Results

The project manager contacted a total of 108 coastal towns along the Maine coast, and received data for 69 towns by the project's data-gathering deadline. Map sets were also received after the deadline, and will be incorporated into a shapefile update at a future time. Polygon datasets titled "Molluscan_Shellfish" are available through the Maine Office of GIS website at <http://www.megis.maine.gov/>.

Discussion

The project provides an overview of known shellfish resource locations, which are obtained from a variety of resources. It is acknowledged that not all shellfish locations are currently represented in the project's data. This lack of data could be a function of a participant's local or personal politics, or their viewpoints regarding the Department of Marine Resources; the lack of response from committees or harvesters; the limited number of shellfish harvesters who participated (as compared to the total number of harvesters in the state); or the periodic variability of shellfish locations over time. Some town shellfish committees chose to mark only shellfish areas with commercial densities, rather than all shellfish locations within a town. It was difficult to obtain shellfish information from some town shellfish committees because of several issues. The committee contact information provided by MDMR Area Biologists was sometimes incorrect, and the project manager had to locate the correct person. Some town committees were unorganized and didn't meet very often: this meant that some maps never made it to the chairman of the shellfish committee, or they were handed to someone else to fill out. Trying to track down who received the maps, and following up with that person, took a significant amount of time. Much time was also spent by the project manager trying to find willing participants knowledgeable about shellfish resources for those towns that didn't have municipal shellfish programs.

The project manager tried to engage several employees in other Department divisions to contribute their local knowledge of shellfish resources. A small amount of shellfish location data were provided by MDMR Area Biologists. A MDMR scientist contributed sea scallop tow survey data. As previously stated, the vast majority of the information was provided by local harvesters and shellfish committees.

More aquaculture lease holders could have been contacted by phone, but there was limited success gathering wild shellfish data from those that were contacted. In the interest of time and other assigned duties, the project manager relied upon other outreach efforts to gather data.

The raster navigational NOAA charts used in the project were both large and small-scale (1:80,000 down to 1: 20,000). The project manager tried to use small-scale charts whenever possible. However, consideration had to be given to adequate chart coverage of the coast, which sometimes was more effective with a large-scale chart. Thought was also given to the fact that, if only small-scale charts were used, the list of NOAA charts needed to correctly view the polygons would have been extensive. The project manager attempted to balance these needs.

Conclusions and Recommendations

The project's shapefiles provide a general overview of Maine molluscan shellfish distribution information, and the "first-hand" knowledge is an asset. As with many data-gathering projects, there is always room for additional data from other participants; and field verification studies would benefit future updates to the shellfish layers. Projects of this nature require adequate communication and cooperation among all participants.

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