

A topographic map of the Frenchman Bay area, showing landmasses in shades of green and brown, and water in light blue. The map is the background for the entire page.

# Frenchman Bay Atlas

Version 1.0 August 2012

Editors: Alex Brett, Chris Petersen, Gordon Longworth



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# Preface

The production of this atlas was motivated by the formation of the Frenchman Bay Partners, a group seeking a sustainable economic and ecological future for the Frenchman Bay region ([www.frenchmanbaypartners.org](http://www.frenchmanbaypartners.org)). The bay is rich in natural resources, both in fisheries and in the natural beauty that draws many visitors throughout the summer season, as well as a growing year-round population. As a result, the bay faces many potential user conflicts and environmental changes from increased development, fisheries and aquaculture activity, and activities associated with tourism.

After some initial work trying to identify potential issues facing the bay, we were struck by the need for baseline information on a range of issues, some based on human activities and land use, while other needs for information focused on the physical and biological environment of the bay and the watersheds that flow into it. This seemed to be a critical early step for any discussions on working toward a sustainable future for Frenchman Bay. After initial conversations between two of us (Chris and Gordon), we brought in Alex to see what information on the bay he could bring together in a couple of months. We have compiled this information as data sets in a GIS program with all of the data layers resident at College of the Atlantic. This atlas is the static version of those data, and the most recent version is available at the COA Geographic Information Systems publications webpage (<http://www.coa.edu/pubsandpresentations.htm>). For each dataset there is documented 'metadata', a description of where the data came from, the date that the data were collected, and detailed definitions of the variables.

In addition to this document, we are adding the geographical databases to an interactive mapping program based at College of the Atlantic's Geographic Information Systems (COAGIS) laboratory. This website allows the user to choose data layers to produce their own customized maps, and the metadata for any feature on the map can be obtained by clicking on that feature. The mapping program is available to the public and can be accessed through the COA GIS online webpage (<http://coagis.maps.arcgis.com/home/index.html>) and then selecting Frenchman Bay.

Before starting the process of creating maps, we conducted searches to amass the collection of data used in the construction of this atlas. This database of geographical knowledge will hopefully allow for the easy production of maps for Frenchman Bay in the future as well as laying the groundwork for conducting analysis with GIS software. This atlas represents the initial version of what we hope to be a constantly evolving document. As more work is done to understand the ecological and cultural state of Frenchman Bay, more maps will be added and present maps will be modified. The majority of information contained

within this first version of the atlas are the data that already existed in some form that could be imported directly into our mapping program (ARCGIS) or could be digitized and turned into data layers that could be mapped. There are many more aspects of the bay to be mapped where the data either do not exist or have not been found and incorporated into our database. For example, current fishing efforts have been largely undocumented in this region, leaving no easy way to illustrate which areas are of importance to fishermen.

One goal with this series of maps is to help communicate what information currently exists for the Bay and its watersheds. A second goal with this series of maps is to help create a dialogue among individuals, organizations, and municipalities about the past, present, and future of Frenchman Bay. That dialogue might help someone understand something they did not know about the bay. It might spark discussion about an aspect of a map that someone believes is incorrect or help someone understand a particular conflict between water use and terrestrial activity. We welcome ideas, corrections, and discussions about these maps. We hope that people will think about ways to examine data and tell stories by combining or adding different layers of data in new ways. All of the data layers are available for use at the College of the Atlantic GIS Lab. To gain access to these data, please contact Gordon Longworth ([glongsworth@coa.edu](mailto:glongsworth@coa.edu)) or Chris Petersen ([cpetersen@coa.edu](mailto:cpetersen@coa.edu)) or try your hand on the interactive mapping page.

Alex Brett

Chris Petersen

Gordon Longworth

College of the Atlantic, Bar Harbor Maine

August 2012

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For more on the details on this license and using or distributing this work, please see the description of the license at <http://creativecommons.org/licenses/by-nc/3.0/>.

# Acknowledgments

This atlas has been the product of many people's work and has relied on the gracious assistance of many people. Help in accessing data was provided by Bob Houston, US Fish and Wildlife Service (USFWS), Seth Barker, Michelle Mason, and Darcie Coutoure, Maine Department of Marine Resources (MEDMR), Christian Halsted and Irene Samur, Maine Department of Environmental Protection (MEDEP), Martie Crone and Bob De Forrest, Maine Coast Heritage Trust (MCHT), Jim Fisher, Hancock County Planning Commission (HCPC), Karen Anderson, US National Park Service (USNPS), Susan Tolman, Maine Geological Survey (MEGS), Gary Ott, US Geological Survey (USGS), George Kidder and Jane Disney, Mount Desert Island Biological Laboratory (MDIBL), Hope Rowan, Island Institute, Glen Mittelhauser, Maine Natural History Observatory, Toby Stephenson, College of the Atlantic (COA), Shaun Donovan, Acadia One Watersports, and David Legere, Aquaterra Adventures.

Although many of the maps were taken directly from publicly accessible GIS layers at different organizations, some of the maps were made by individuals either in recent projects or specifically for this atlas. Rachel Guttmacher helped significantly in the analysis of data and production of several maps as part of an independent study at COA. Barbara Beblowski assisted in compiling the red tide closures data as part of a GIS class project. Robb Freeman of Eastern Maine Community College (EMCC) organized the production of the eelgrass map by students in his GIS class.

Photo credit: Section titles – Alex Brett (Sections 1-3), Chris Petersen (Section 4).

The planning committee of Frenchman Bay Partners helped set goals for the atlas and provided revision suggestions throughout the process. Many other individuals have provided editorial comments on version 1.0 and we are grateful for all of their help. In particular we would like Alison Pierik and Victoria Terry for their editorial comments.

About the editors:

As an editorial team, each of us had specific roles in the creating of this atlas. For better or worse, Chris Petersen was instrumental in the whole process of developing the atlas from initial planning to final revisions. Gordon Longworth assisted with GIS operations and made his lab available for the work, and provided consultation throughout the process. The main job of compiling version 1.0 of this atlas fell to Alex Brett, who did this work as an extern on a grant from the Long Cove Foundation to Chris Petersen and is currently a fisheries observer in the Pacific Northwest.



# Section 1: Basemaps

These maps provide a general overview of the Frenchman Bay Watershed.

## A note about the maps

For most maps, the watershed that drains into Frenchman Bay is highlighted relative to the rest of the land. In many cases, the watershed is highlighted with a slight green hue relative to adjacent land not in the watershed which is grey. For the map on the right all of the towns are highlighted, but for most towns there is a darker color for the part of the town or unincorporated district that is within the drainage, and a lighter color with the same hue for the part of the town not in the Frenchman Bay drainage. For a town like Ellsworth, most of the town drains into Blue Hill Bay, and only some small sections in the southeast portion of the town that drain into Frenchman Bay are darkened.

# Towns and Villages



00.51 2 3 4 Miles

# Aerial Photography

**Summary:** This map is composed of two sets of aerial photographs. The photographs covering the shoreline and showing the extent of the mudflats are from a series of flights by the Maine Department of Marine Resources in 2008. The photographs covering the inland areas that are a lighter shade of green are from the 2011 survey flights flown as part of the National Agricultural Imaging Program.

The photographs displayed here are orthophotos, which means that they have been corrected to remove distortion and fit on an accurate scale. That means that it is possible to perform measurements and other similar operations as if it were a map.

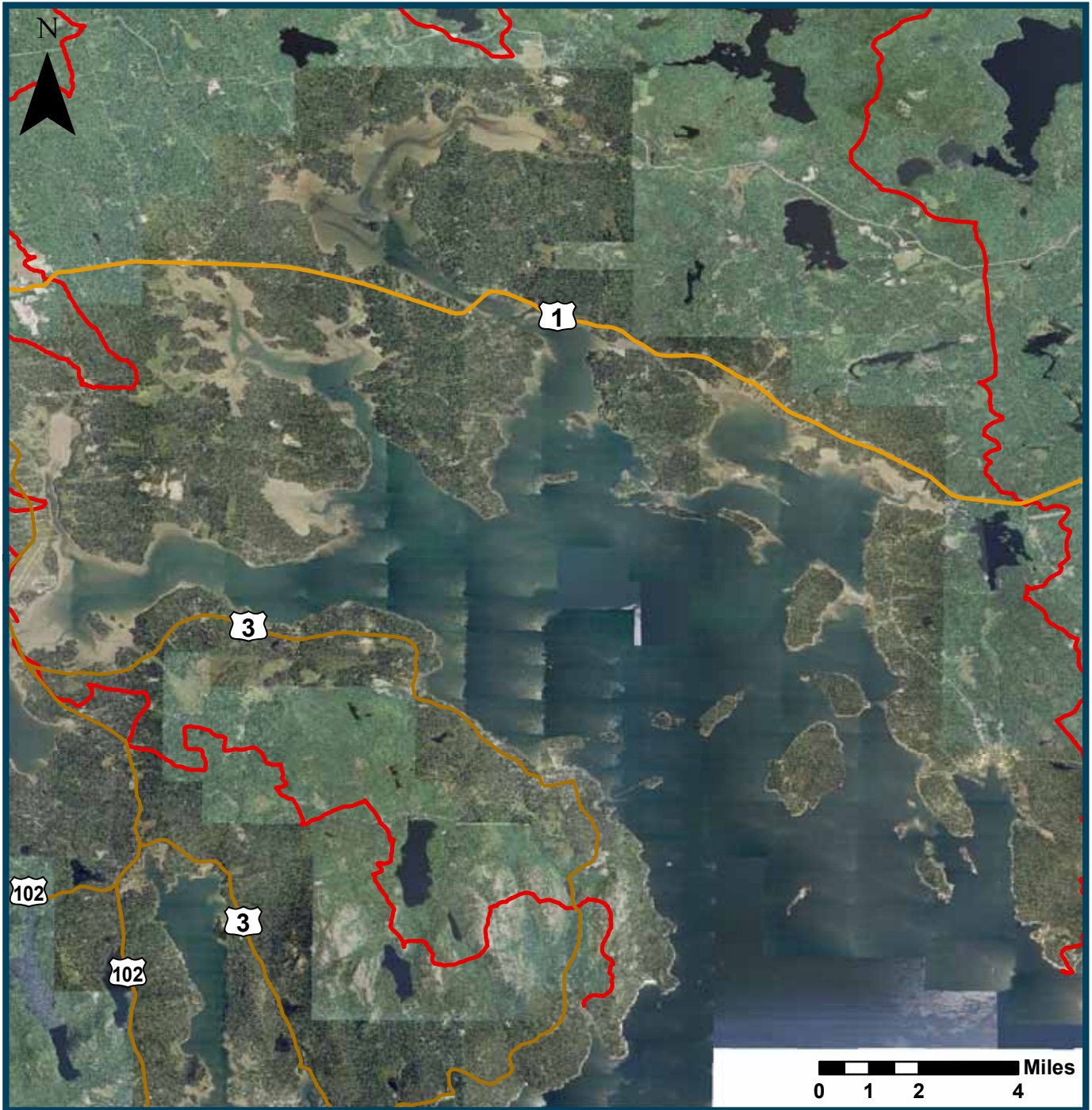
Superimposed on the map are several roads in brown and the boundary of the Frenchman Bay Watershed in red.

## Data Sources

2008 Low Tide Orthophotos-Maine Department of Marine Resources/Maine Office of GIS-<http://www.maine.gov/megis/catalog/>

2011 National Agricultural Imaging Program Orthophotos-US Department of Agriculture/Maine Office of GIS-<http://www.maine.gov/megis/catalog/>

# Aerial Photography



## Legend

- Frenchman Bay Watershed
- 2008 Low Tide Orthophotos
- 2011 National Agricultural Imaging Program Orthophotos

*Data Sources: Me Office of GIS, Me Department of Marine Resources, US Department of Agriculture*

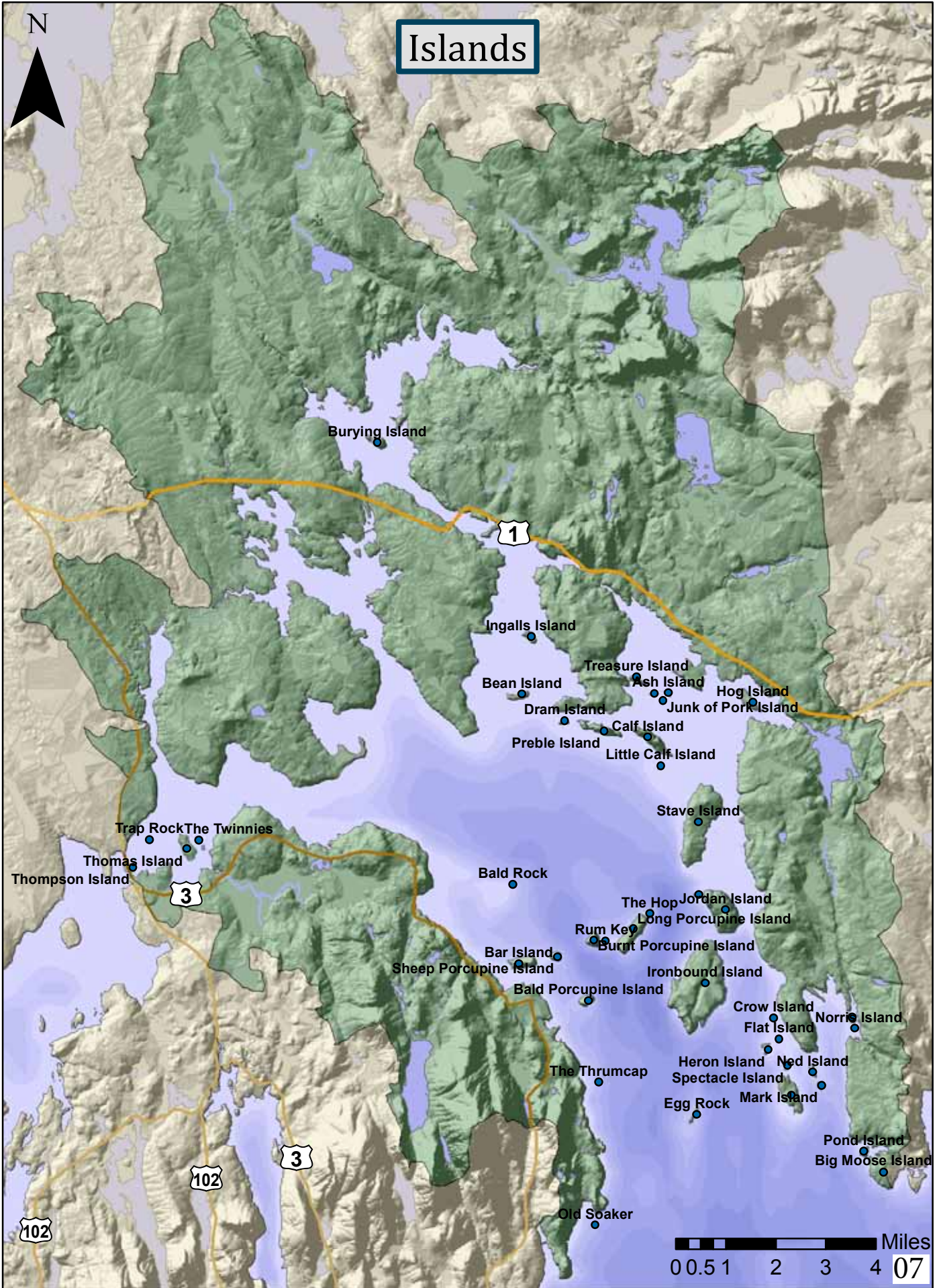
# Major Streams and Rivers



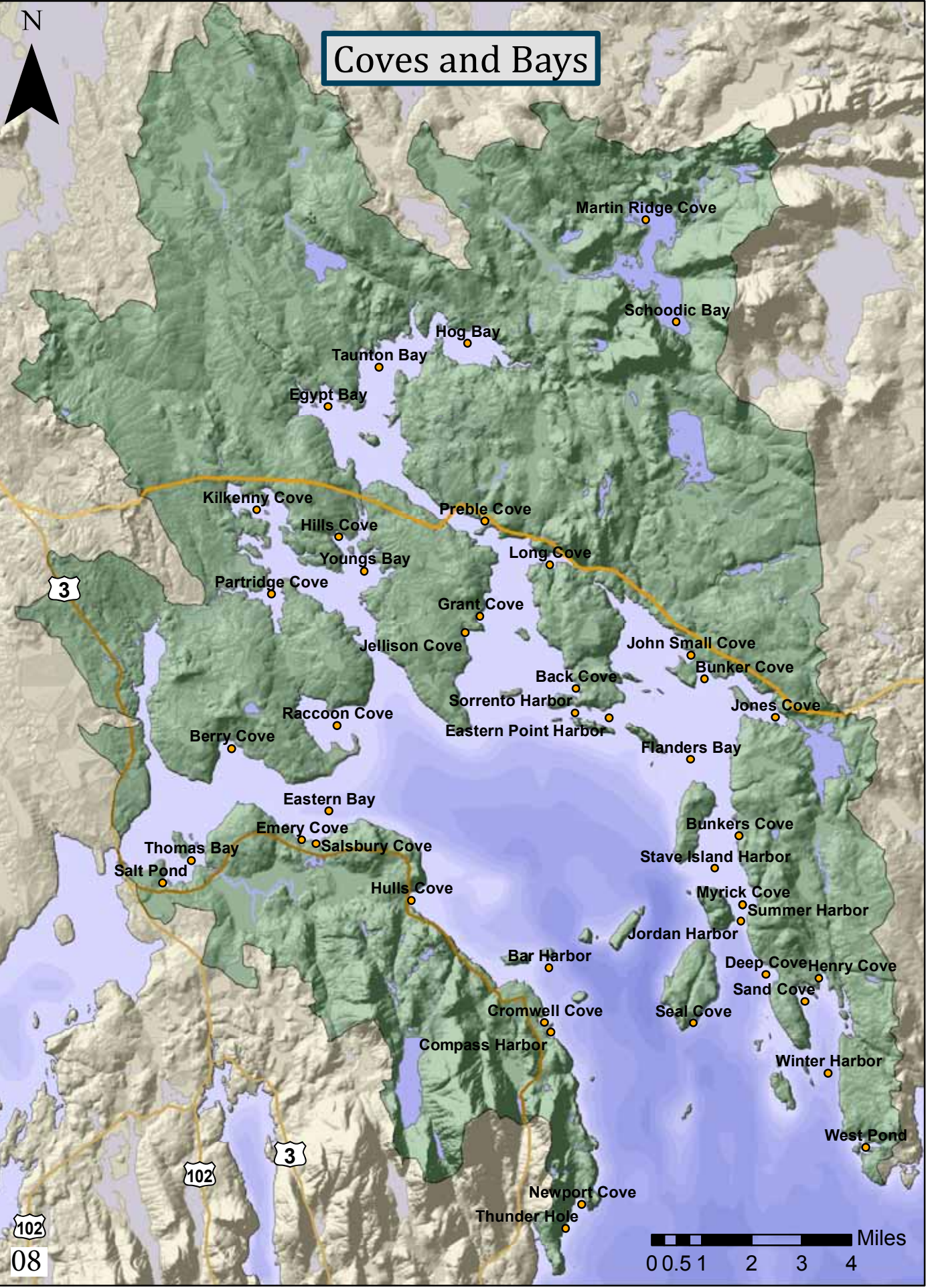
102  
06

Miles  
0 0.5 1 2 3 4

# Islands



# Coves and Bays





## Section 2: Ecology

These maps illustrate the geology and ecology of Frenchman Bay and the surrounding lands.

# Surficial Geology

**Summary:** Understanding the surficial geology of a region is one of the first steps in planning for conservation and land use. However, it is important to understand that the term surficial geology does not necessarily refer to the materials that are immediately visible when walking around a landscape. Instead, it refers to the loose materials, such as clay and gravel, that lie beneath the upper layer of soil.

The surficial geology of the Maine coast is primarily the product of the most recent glacial episode, which started around 35,000 years ago. As the ice advanced across the coast ice sheets scoured the landscape, shaping the mountains that are symbolic of the Frenchman Bay area. As the glaciers receded across the coast around 11,000 years ago, they deposited many of the surficial sediments that make up our present-day geology.

## Definition of terms:

**Esker**-A ridge of sand and gravel deposited by subglacial rivers. Often covered in a layer of glaciomarine silt, clay and sand.

**Till**-A poorly sorted mixture of sand, silt, clay and large stones deposited from glacial erosion.

**Thin drift**-Areas of till that generally have less than 10 ft of sediment on top of the bedrock.

**Ice contact deposits**-Gravel and sand deposited at the ice sheet edge as the ice melted.

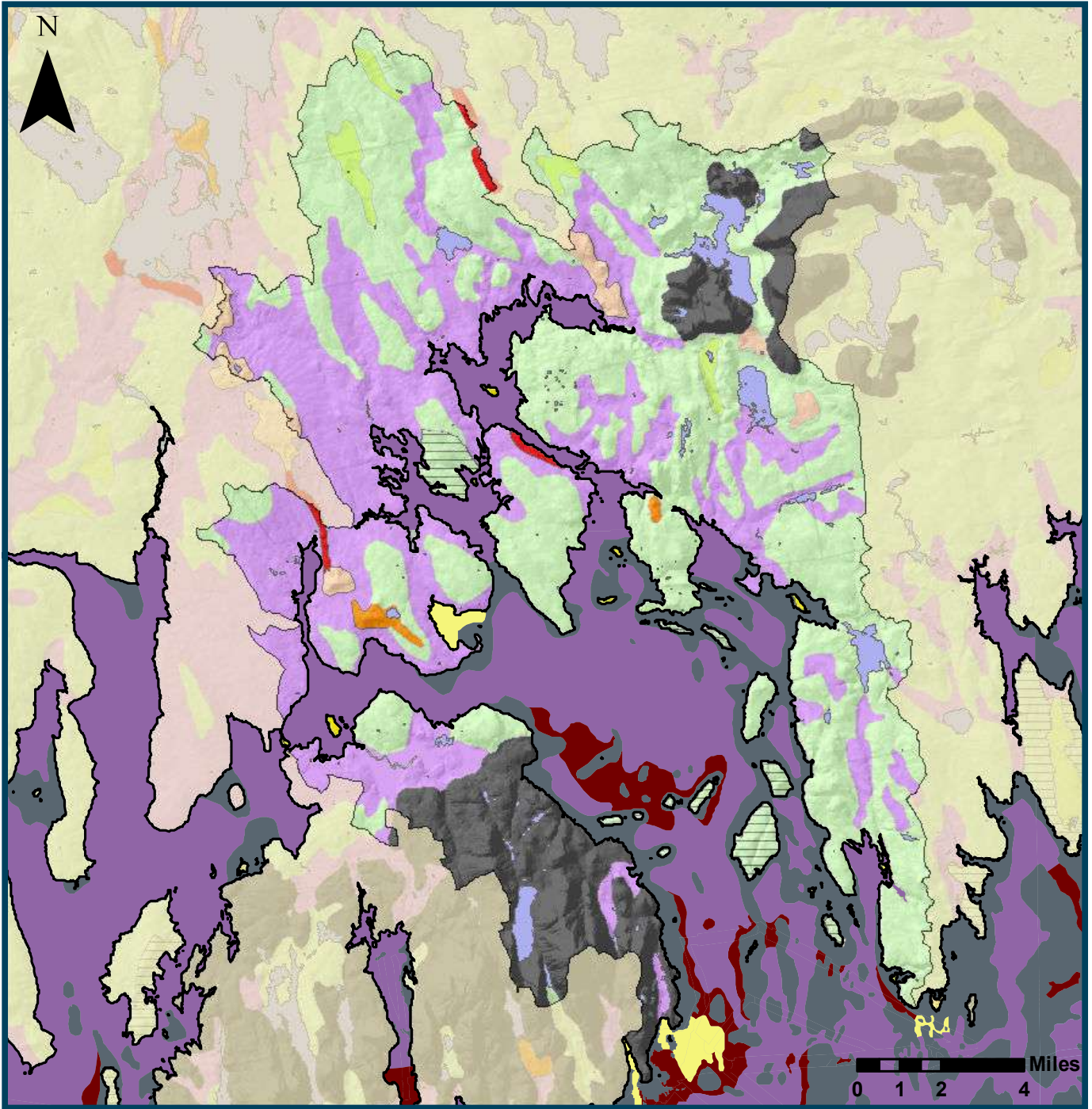
**Glaciomarine sediments**-Sand, gravel, and some silt deposited by glacial meltwater into the ocean near the ice edge.

## Data Sources

Terrestrial surficial geology-Maine Geological Survey-  
<http://www.maine.gov/doc/nrimc/mgs/mgs.htm> (Agency website)  
<http://www.maine.gov/megis/catalog/> (Data source)

Marine surficial geology-Maine Geological Survey-<http://www.maine.gov/doc/nrimc/mgs/mgs.htm>

# Surficial Geology



## Legend

- |                      |        |  |
|----------------------|--------|--|
| Gravel               | Rock   | Glaciomarine deposits - fine grained   |
| Mud                  | Eskers | Glaciomarine deposits - medium grained |
| Rock                 | Till   | Unknown - mostly islands               |
| Sand                 | Swamp  | Thin drift - undifferentiated          |
| Ice contact deposits |        |  |

*Data Sources: Maine Office of GIS  
Maine Geological Survey*

# Eelgrass distribution

**Summary:** Eelgrass (*Zostera marina*) is a flowering plant found in marine environments from the low intertidal zone to the shallow subtidal. Because it provides structural complexity to otherwise soft-sediment environments that have very little environmental structure above the bottom, it is thought to provide habitat and potential places to avoid predation for a variety of marine animals, especially juveniles. It also is reported to supply several ecosystem services including stabilizing sediment and thereby protecting coastlines from erosion, reducing sediment loads in the water column by providing areas of lower flow and sediment deposition, and by reducing nutrients in the water column through its photosynthesis.

Historically, eelgrass appears to have had high variability in its distribution. A mass mortality of eelgrass in the 1930's throughout most of its habitat that was believed to be due to a slime mold has been implicated in the extinction of the small limpet, *Lottia alevus*, that lived on eelgrass. The eelgrass apparently continued to live in estuarine waters where the slime mold could not survive, but this refugia was apparently too brackish for the limpet as well.

Recently, eelgrass has also appeared to experience a strong decline in its local distribution. Eelgrass was much more abundant in 1996 compared with 2008, based on aerial surveys taken by Maine DMR. This loss has led to a continuing effort by Dr. Jane Disney at Mount Desert Island Biological Laboratory (MDIBL) to restore eelgrass by transplanting eelgrass to locations that had lost most or all of its eelgrass in the recent past.

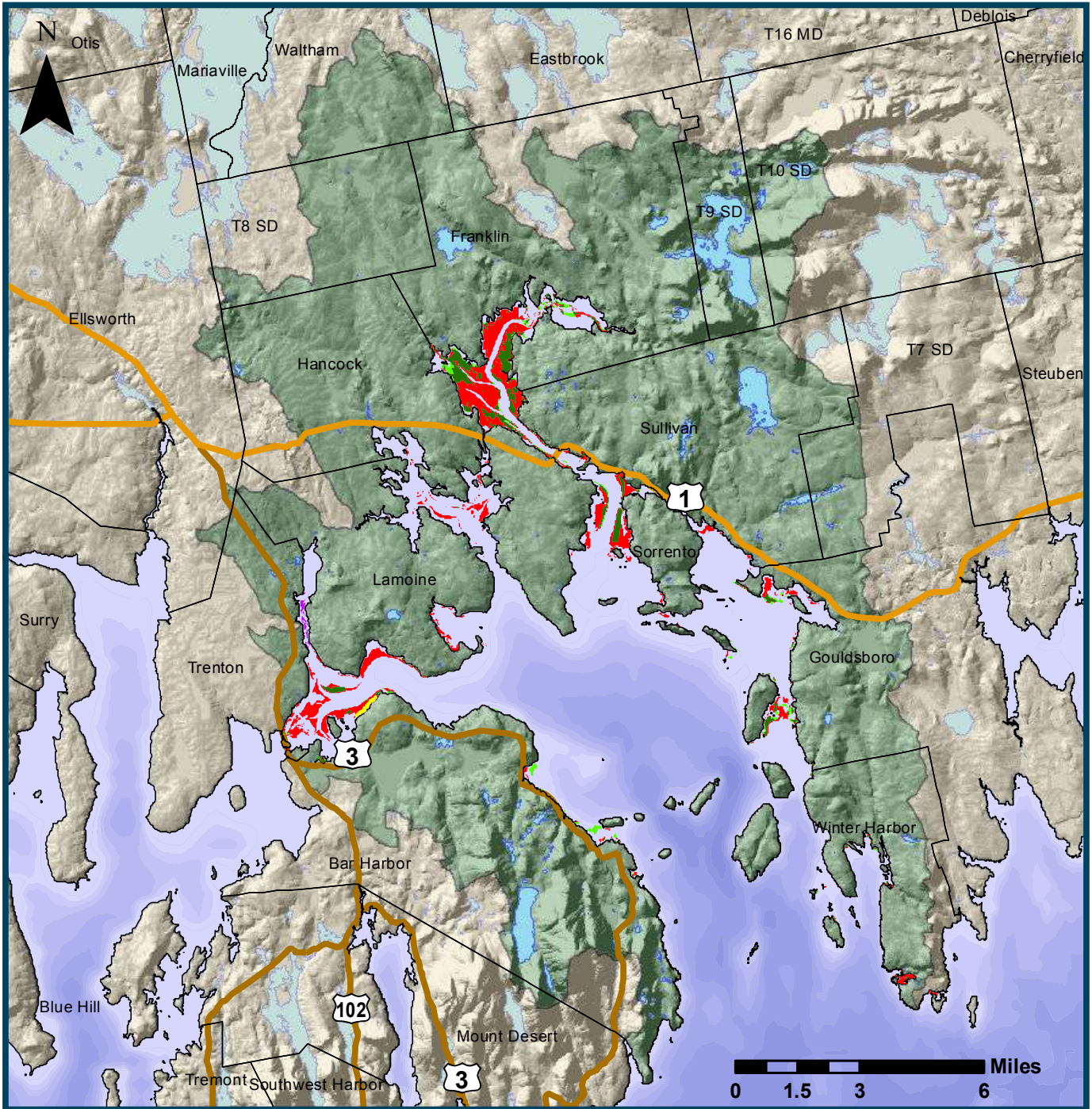
## Data Sources

ME office of GIS

Seth Barker, DMR 2008 aerial photograph

Jane Disney, MDIBL eelgrass restoration project

# Eelgrass Distribution 1996-2011



## Legend

- Hadley Point Restored Eelgrass Area
- Eelgrass Gain 1996-2008
- Eelgrass Loss 1996-2008
- Eelgrass Present 1996 and 2008
- Eelgrass Present 2008, Absent 2011

*Data Sources: ME Office of GIS,  
Seth Barker, DMR 2008 aerial photo  
Jane Disney, MDIBL 2011 Eelgrass Restoration Polygon*

Felicia Graham, Tom Graham, Brad Haskell, Mike Houlsen  
and Robb Freeman. Eastern Maine Community College

# Valuable Habitat Areas

**Summary:** The data presented on this map are a subset of the data compiled through Beginning with Habitat, a collaborative program for habitat conservation in the state of Maine. Habitats presented here are the result of mapping efforts by a variety of federal, state, and non-governmental organizations. More information on all data can be found at: <http://www.beginningwithhabitat.org/index.html>

**Exemplary Communities-** The Maine Natural Areas Program (MNAP) classifies communities throughout the state by their type and rarity. This layer displays areas that are particularly rare or exemplary instances of common communities. An overview of the community classification program can be found at: <http://www.maine.gov/doc/nrimc/mnap/features/community.htm>

**Deer Wintering Areas-** Areas that may be used by deer during conditions of deep snow and cold weather. [http://www.maine.gov/ifw/wildlife/species/pdfs/DWA\\_Guidelines\\_2.4.10.pdf](http://www.maine.gov/ifw/wildlife/species/pdfs/DWA_Guidelines_2.4.10.pdf)

**Significant Shorebird Habitat-** Areas of the coast that provide feeding or roosting habitat for migrating shorebirds. Some of the features include mud flats, gravel bars, and sand spits.

**Seabird Nesting Islands-** Sites of documented seabird nesting or areas suitable for nesting by endangered seabirds.

**Inland Waterfowl and Wading Bird Habitat-** Areas used for migration, breeding, or feeding by tidal waterfowl/wading birds.

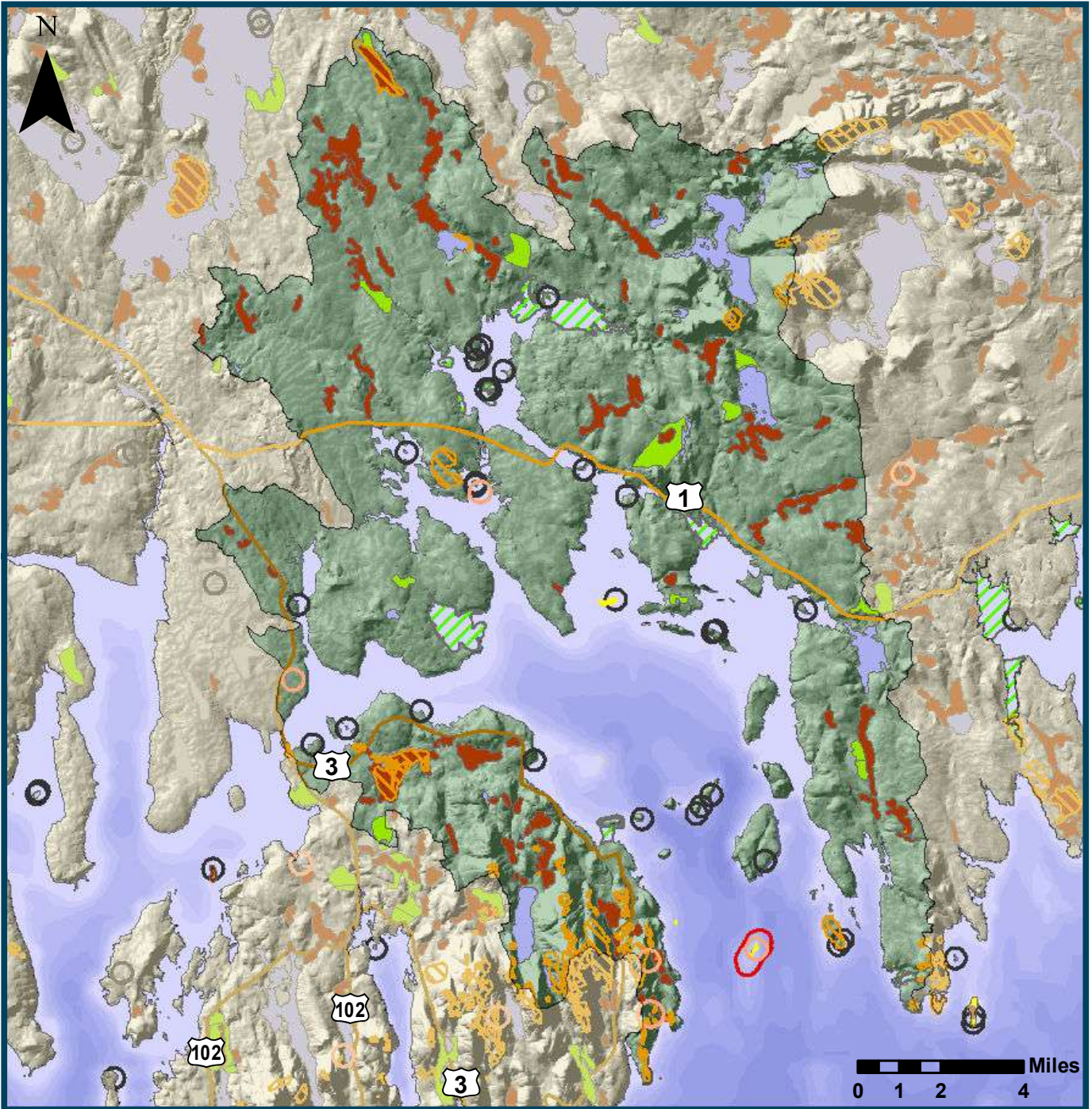
**Bald Eagles/Roseate Tern Nest Sites-** Essential habitat for the two species as defined by the Maine Endangered Species Act.

**Locations of Endangered/Threatened Species-** Sites where species that are endangered, threatened, or of special concern as determined by the Maine Department of Inland Fish and Wildlife, are found.

## Data Sources

Habitat value data-Beginning with Habitat-[http://www.beginningwithhabitat.org/the\\_maps/gis\\_data\\_request.html](http://www.beginningwithhabitat.org/the_maps/gis_data_request.html)

# Valuable Habitat Areas



## Legend

- |   |                                |
|---|--------------------------------|
| Buffered Locations of Endangered/Threatened Species | Seabird Nesting Islands-NRPA   |
| Exemplary Communities-MNAP                          | Buffered Bald Eagle Nest Sites |
| Inland Waterfowl and Wading Bird Habitat            | Significant Shorebird Habitat  |
| Buffered Roseate Tern Nest Sites                    | Deer Wintering Areas           |

*Data Sources: Me Office of GIS, Beginning with Habitat Program, Me Department of Marine Resources, Me Department of Inland Fish and Wildlife*

# Marine Resources

**Summary:** Frenchman Bay supports several commercially viable marine organisms that in turn support a broad range of fishing activities. Like in most of Maine, American lobster (*Homarus americanus*) represents the bulk of the effort, but many other organisms are commonly harvested, including sea scallops (*Placopecten magellanicus*), and blue mussels (*Mytilus edulis*). Commercial operations are not limited to the species listed here and include sea cucumber (*Cucumaria frondosa*) harvesting and harvesting of several species of algae in the intertidal and shallow subtidal zone.

One detail that becomes readily apparent from this map is that the shellfish and worm resources of the bay are primarily concentrated in the upper bays and have large amounts of overlap. Although this is to be expected given the similar environmental requirements of the organisms, it is still an important detail. This can lead to a concentration of harvesters, making it important to take steps to minimize potential user conflicts. It also demonstrates the importance of keeping the upper bays and mudflats healthy and free of contamination from runoff and other pollution sources.

## Legend Description

**2010 Shellfish Habitats**-These data layers are the product of a series of interviews with harvesters, town officials, and Maine Department of Marine Resources staff conducted between 2008 and 2010 by Maine DMR. The official report on the project ([http://www.maine.gov/dmr/rm/public\\_health/2009molluscanmapping.pdf](http://www.maine.gov/dmr/rm/public_health/2009molluscanmapping.pdf)) acknowledges that there may be some gaps in the data resulting from the difficulty of interviewing such a wide range of individual, but it represents the best data on shellfish distribution for the state.

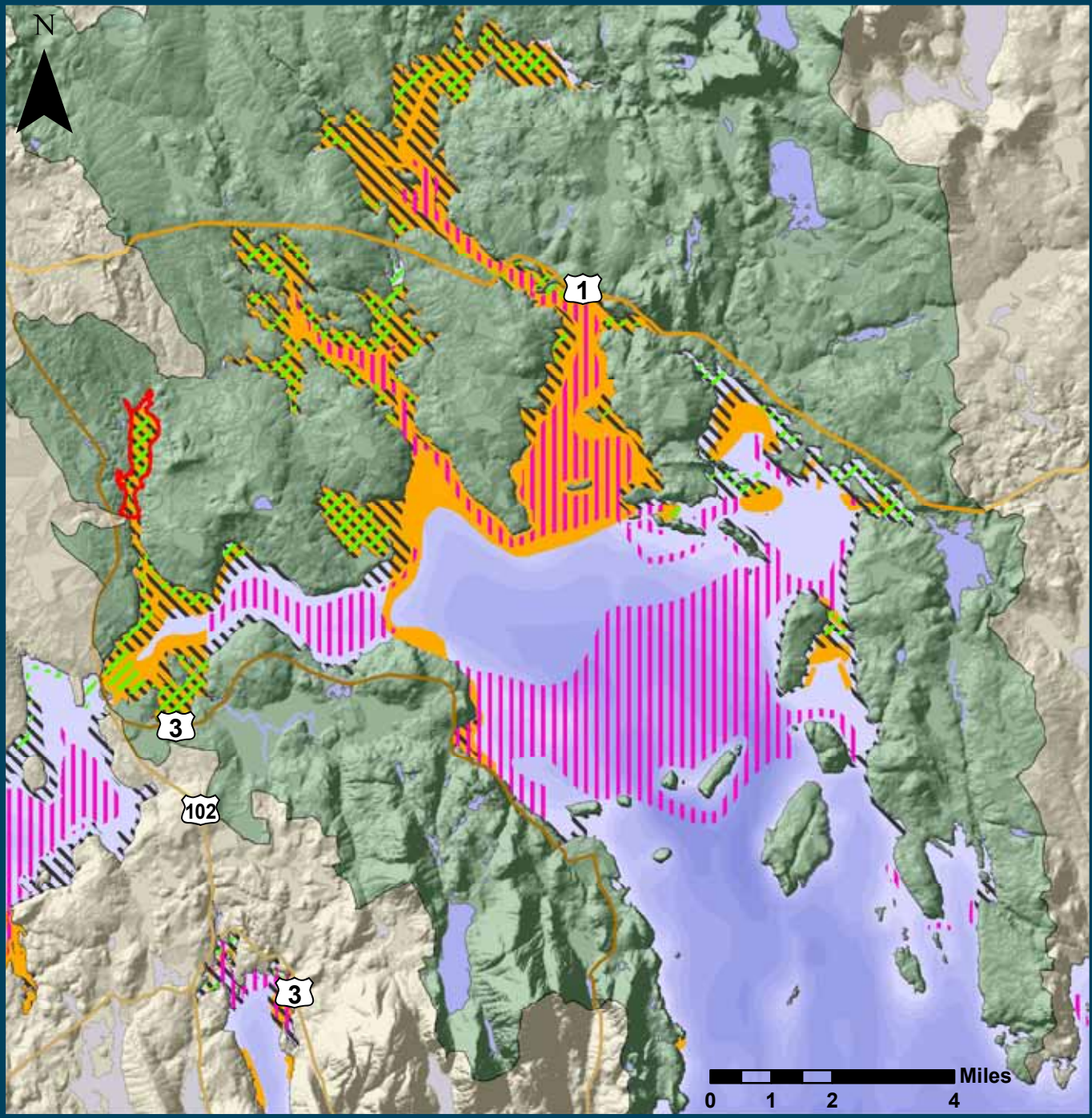
**Worm Habitat 2005**-A generalized distribution of commercially-harvested worm species along the Maine coast. These data were generated during a coastwide survey by Maine DMR to quantify the current and historic harvest locations of clam worms (*Nereis virens*) and blood worms (*Glycera dibranchiata*)

**Seed Mussel Conservation Areas**-Areas that have been established by Maine DMR regulations as zones where permits are required to take mussels.

## Data Sources

2007 Shellfish Habitat, Shellfish Habitat 1977, Worm Habitat mid-1970's, Seed Mussel Conservation Areas - Maine Department of Marine Resources/Maine Office of GIS - <http://www.maine.gov/megis/catalog/>

# Marine Resources



### Legend

- Seed Mussel Conservation Area
- Commercially Harvested Worm Habitat 2005
- Sea Scallop Habitat 2010
- Softshell Clam Habitat 2010
- Blue Mussel Habitat 2010

Data Sources: Me Office of GIS,  
Me Department of Marine Resources

# Wetland and Vernal Pool Habitats

**Summary:** Wetlands are considered as important primarily for their ecological value, but they also can also have cultural value as hunting, fishing and birdwatching locations. In spite of this, they face many threats from human activities. These range from direct dangers such as being drained and filled for development to more indirect actions such as pollution that degrades water quality.

Wetlands are thought to provide valuable ecosystem services including increasing water quality, acting as a buffer for coastal regions from storms, and providing important habitat for a variety of species. They are a vital nursery habitat for many species of fishes and invertebrates that take advantage of cover and plentiful food provided by the wetland during their early development. This high concentration of young in turn makes wetlands good feeding grounds for many species of waterbirds. In addition to their inherent value as habitat, they also make excellent regions for boating, fishing, and birding. In times of heavy rainfall, wetlands also act as a naturally occurring buffer to slow down and absorb the energy of the potential floodwaters.

## Legend Description

**Wetland Value**-These data were created by the State Planning Office to determine the ecological and cultural importance of state wetlands. All wetlands in the state that have been mapped through the National Wetland Inventory were assessed for six different criteria: floodflow alteration, sediment retention, plant and animal habitat, finfish habitat, shellfish habitat, and cultural/educational value. Higher values were assigned to wetlands that fulfilled more of these criteria.

**Vernal Pools**-Vernal pools are temporary bodies of water that most often appear in the springtime. Their transient nature means they are generally free of fish, which makes them an excellent nursery for many species of amphibians. Vernal pools determined to be significant habitat are protected by state law under the Natural Resources Protection Act.

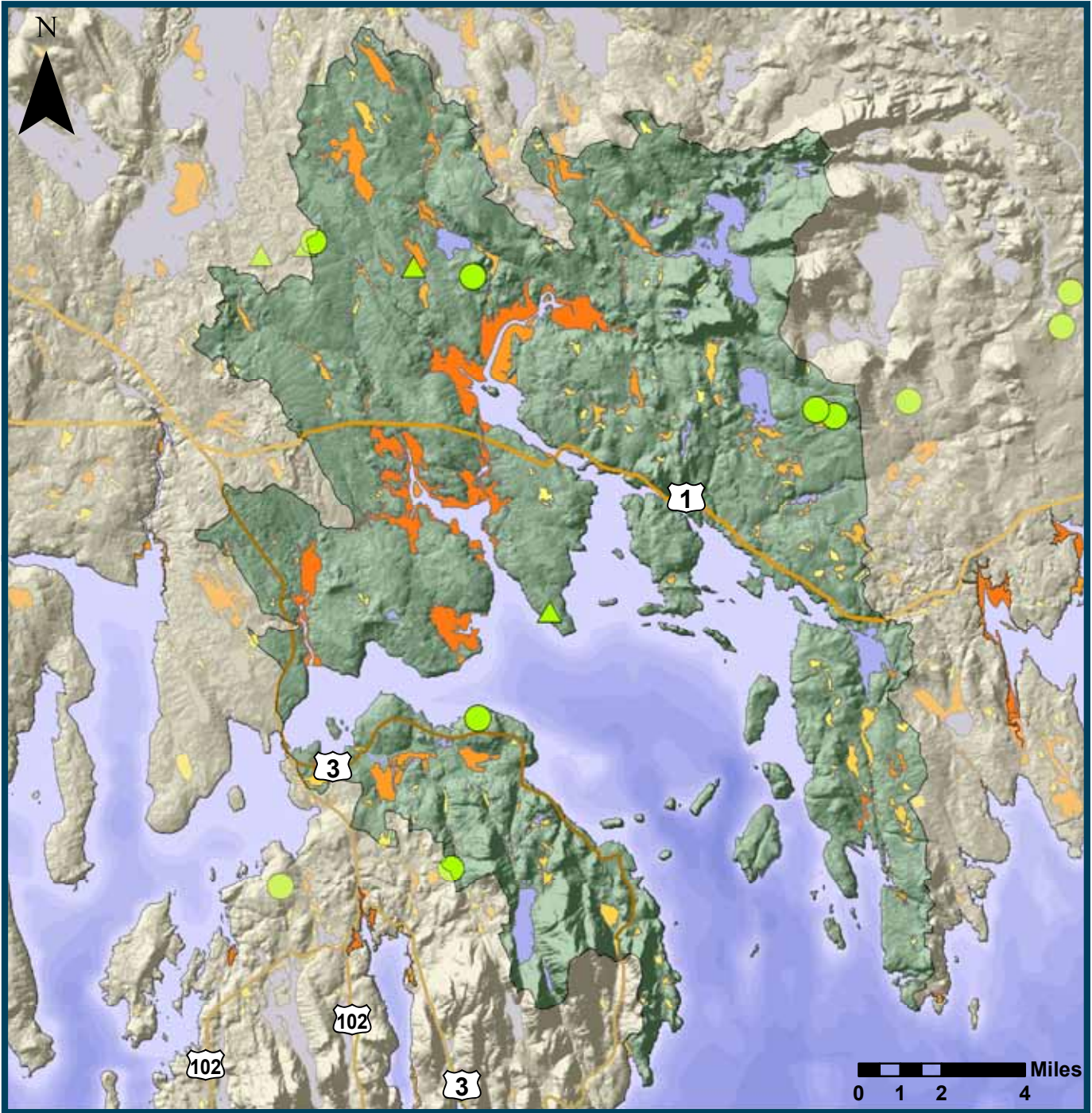
<http://www.maine.gov/dep/land/nrpa/vernalpools/index.html>

## Data Sources

Wetland Characterization - State Planning Office/Maine Office of GIS - <http://www.maine.gov/megis/catalog/>

Vernal Pool Habitats - Beginning with Habitat Program - <http://www.beginningwithhabitat.org/index.html>

# Wetland and Vernal Pool Habitats



## Legend

### Vernal Pool Status

- ▲ Potentially Significant
- Significant

### Wetland Value

- 0
- 1
- 2
- 3
- 4
- 5
- 6

Wetland values are an attempt by the State to classify wetlands by their ecological and cultural importance.

Data Sources: Me Office of GIS,  
Me Department of Inland Fish and Wildlife

# Shore and Waterbird Habitat

**Summary:** The data displayed on this map are the product of a modeling project by the US Fish and Wildlife Service's Gulf of Maine Coastal Program. The Gulf of Maine Watershed Habitat Analysis covered 91 species of birds and fishes. Species were chosen for inclusion if they were federally endangered or threatened, threatened or endangered in at least two states bordering the Gulf of Maine, declining on a nationwide scale, or had been identified as priorities by other management plans.

Habitat was rated as valuable based on a combination of verified sightings and habitat modeling. Models ranking habitat values were built around known environmental parameters for the species and were validated based on overlap with verified occurrence of the species. It is important to remember that while they have been validated to varying degrees, these data still only represent what is believed to be good habitat for the given species; they say nothing about actual presence or absence.

Because intertidal and shallow subtidal habitat is of critical importance to many shore and waterbirds, this map largely reflects the contours of the coastline, with higher habitat values for shallow mudflats and upriver habitat in the upper bay, particularly in Taunton Bay.

## **Species included in this map:**

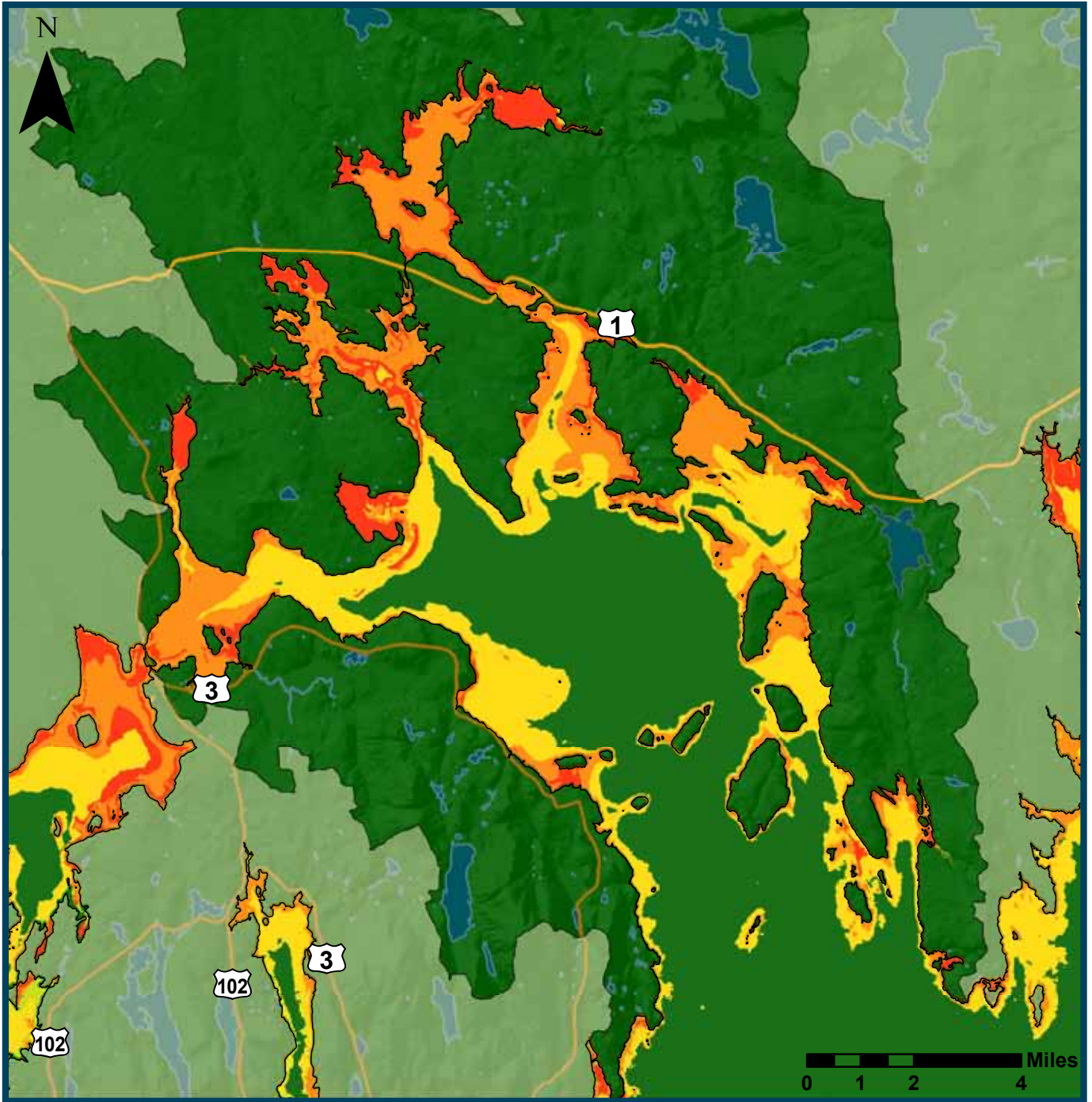
American oystercatcher, buff-breasted sandpiper, Hudsonian goodwit, ruddy turnstone, solitary sandpiper, little blue heron, snowy egret, little gull, tricolored heron, black-bellied plover, killdeer, least sandpiper, purple sandpiper, red knot, sanderling, semipalmated sandpiper, short-billed dowitcher, snipe, upland sandpiper, whimbrel, American woodcock, arctic tern, American bittern, American black duck, black tern, common loon, least tern, pied-billed grebe, greater scaup, lesser scaup, black scoter, white-winged scoter, surf scoter, wood duck.

## **Data Sources**







Habitat value analysis - US Fish and Wildlife Service -

<http://www.fws.gov/GOMCP/identify.html#GOMwatershed> (Full species list available here)

# Shorebird and Waterbird Habitat Value



## Legend

	3 - 135		346-450
	136-240		451-555
	241-345		556-2,274

Numbers represent the habitat suitability for 32 species of shore and waterbirds selected based on their declining numbers or designation as threatened or endangered. The values are the results of a habitat characterization model and do not necessarily indicate the presence of the species.

*Data Sources: Me Office of GIS, US Fish and Wildlife Service*



A photograph of a harbor scene. In the foreground, a white boat with a cabin and a mast is docked. The boat has the number '981188' on its side. In the background, there are buildings and a hillside under a cloudy sky. The water is calm with some ripples.

## Section 3: Culture

This section describes the human population of Frenchman Bay.

# Population Change

**Summary:** Basic population statistics are an important component to regional planning efforts, and the US Bureau for the Census has a wide range of data on the subject. Rates of population change are interesting, because they can highlight areas that will be facing higher pressure on local resources, but it is only one of the many available pieces of census data. This map displays the rates of population change between 2000 and 2010 in the Frenchman Bay Region.

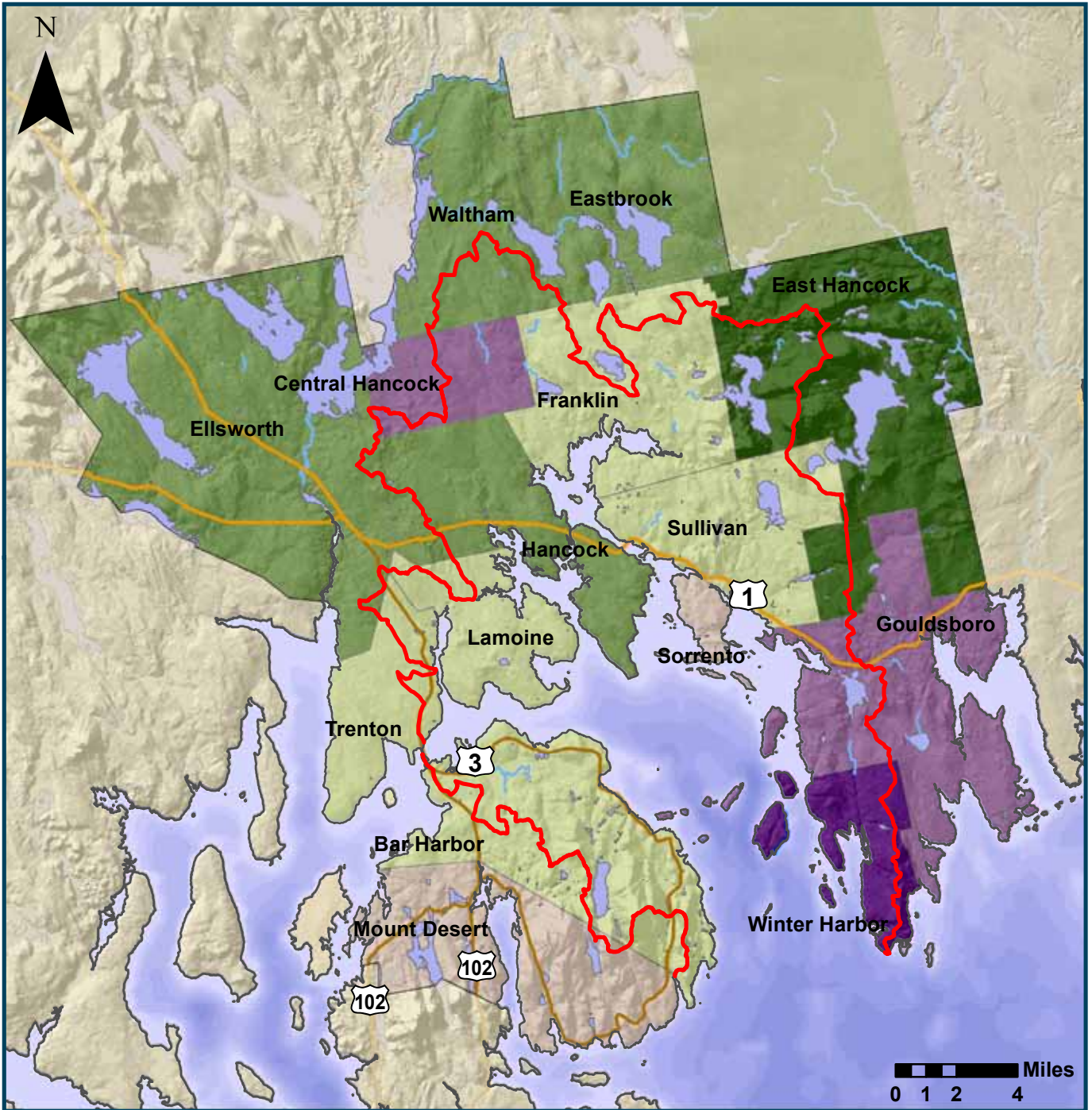
Across the region, there is a general trend of population growth, except for the towns of Mount Desert, Winter Harbor, Gouldsboro, and the unincorporated townships of Central Hancock. Of all the changes, Winter Harbor had the most drastic population change with a decrease of 47%. This decline was almost certainly caused by the 2002 closure of NGS Winter Harbor, the naval radio base.

A map like this is most interesting in conjunction with other maps, such as the following map displaying the change in number of housing units over time. One example is that by viewing these maps together, it becomes apparent that although the town of Mount Desert is shrinking in population size, the number of housing units has actually increased over the same time period.

## Data Sources

Maine census data-Maine Office of GIS/US Bureau of the Census-<http://www.maine.gov/megis/catalog/>

# Population Change 2000-2010



## Legend

- Frenchman Bay Watershed
- -50 to -20%
- -20 to -10%
- -10 to 0%
- 0 to 10%
- 10 to 20%
- 20 to 30%

Data Sources: Me Office of GIS,  
Hancock County Planning Commission, US Bureau for the Census

# Housing Unit Change

**Summary:** Understanding the pace and extent of coastal development is crucial for managing an area. Rapid, widespread development is a potential danger in an area such as Frenchman Bay that relies heavily on natural resources, both for tourism and for the fishing industry. However, mapping development is a difficult process and involves many variables. The data presented here are one proxy for rate of development.

The most accessible proxy available for development rates is the change in number of housing units. As part of the nationwide census, the US Bureau of the census gathers information about numbers of housing units on a town by town basis. To generate this map, the data from 2010 and 2000 were compared to produce the rate of change over the ten-year period. Past data for housing units could not be found for the unincorporated areas of the watershed, so these data were not included in the dataset displayed here.

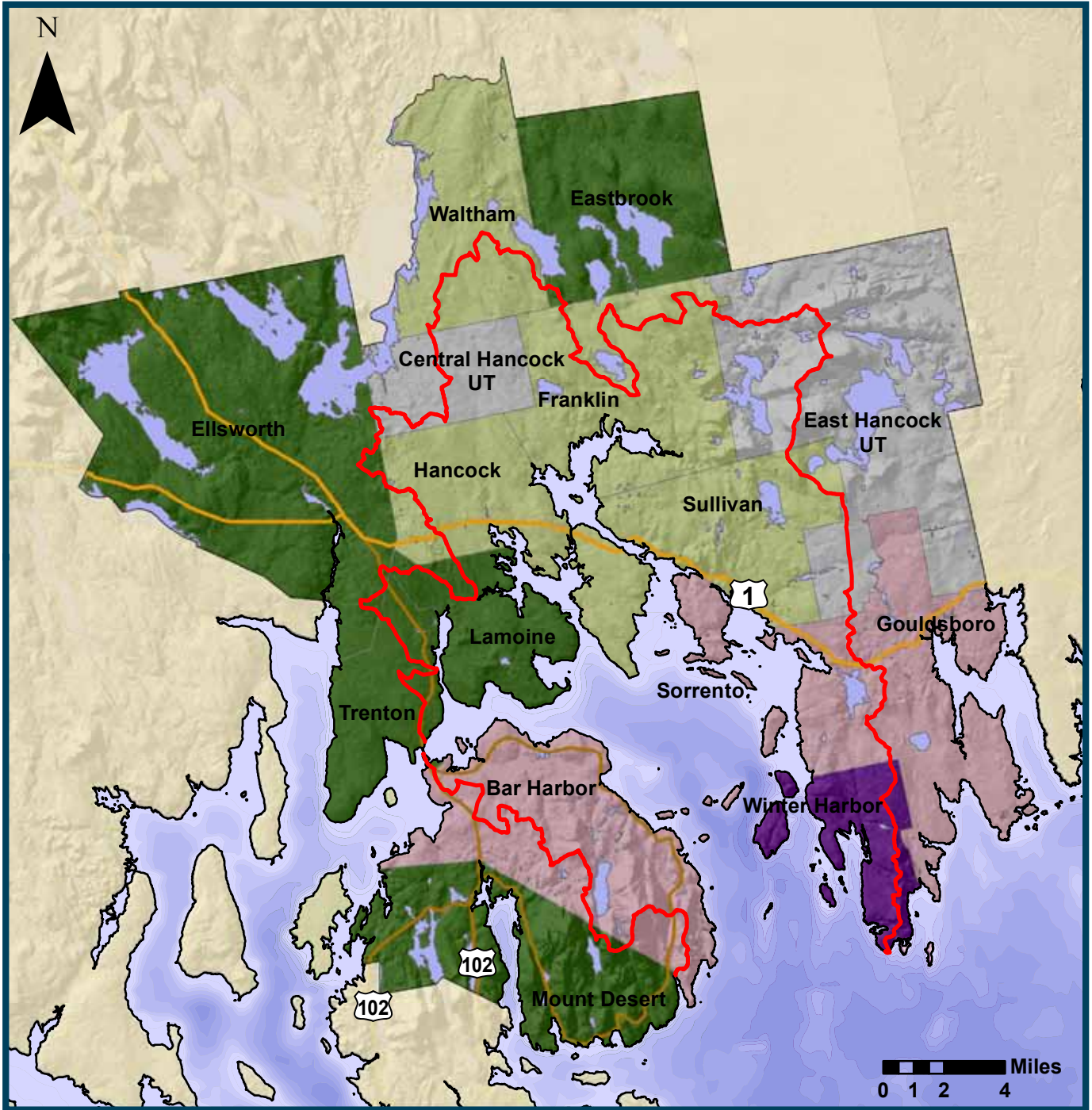
The general trend of almost all communities was an increase in housing units. The only town that showed a decrease in units was Winter Harbor, which is likely the result of the 2002 closure of the Naval Radio Base in Winter Harbor.

## Data Sources

Housing Unit Data-Hancock County Planning Commission/US Bureau of the Census-

<http://www.hcpcme.org/pubadmin/census.html>

# Change in # of Housing Units 2000-2010



## Legend

- Frenchman Bay Watershed
- No Data
- 10 to 0%
- 0 to 10%
- 10 to 20%
- 20 to 30%

Data Sources: Me Office of GIS,  
Hancock County Planning Commission, US Bureau of the Census

# Coastal Development

**Summary:** This map is a useful aid for planning for the future of the bay, because it highlights the areas of the coast that are currently under the highest pressure from coastal buildings. Coastal development can have adverse environmental impacts through runoff and can alter the character of an area through land clearing. Coastal development can also make coastal access more difficult when new development or change in ownership limits waterfront access.

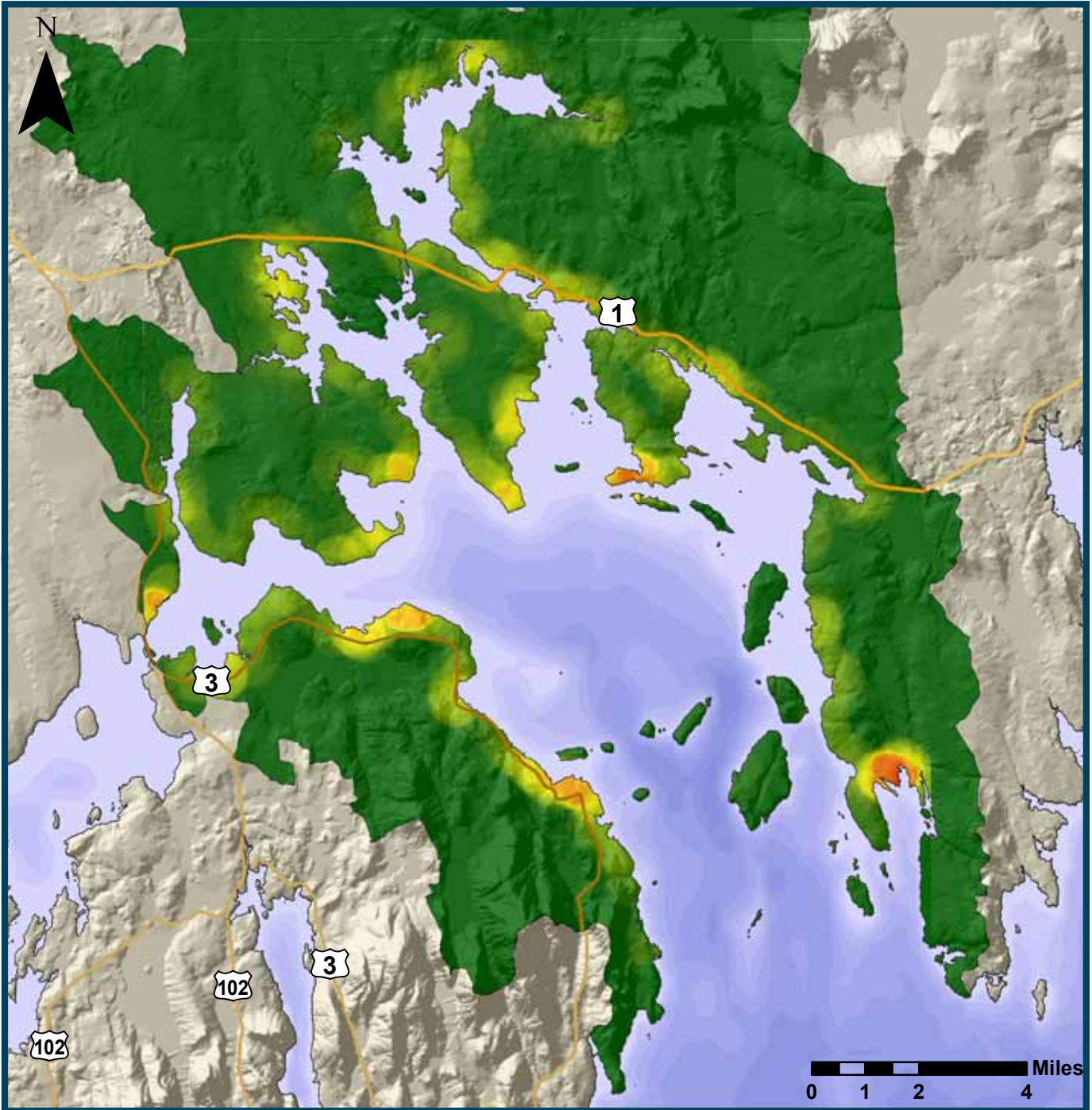
The data presented also serve as a supplement for other datasets presented in maps in the atlas. In combination with the development tracking map that show trends in development rates over a six-year period, this map highlights the areas that are facing the most development stress, both currently and in the future. Areas that show both high growth rates from the development tracking data and an existing high density of coastal buildings face the most potential development stress.

To produce this map the 2011 NAIP orthophotos were used to digitize the locations of all buildings within 500 feet of the shoreline. GIS software was then used to generate the building density plot displayed on this map. It is important to note that because of the way the data were processed there is density data on the map extending farther inland than 500 feet, but that is just an artifact of the model used and does not necessarily represent actual building density.

## Data Sources

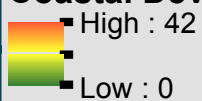
Coastal Building Density - College of the Atlantic - <http://coa.edu/gis-lab.htm>

# Coastal Development



## Legend

### Coastal Development



These numbers represent the concentration of buildings within 500 ft. of the shoreline. Orange areas have a higher density and green areas have a low density.

*Data Sources: Me Office of GIS,  
National Agricultural Imaging Program*

# Development Tracking

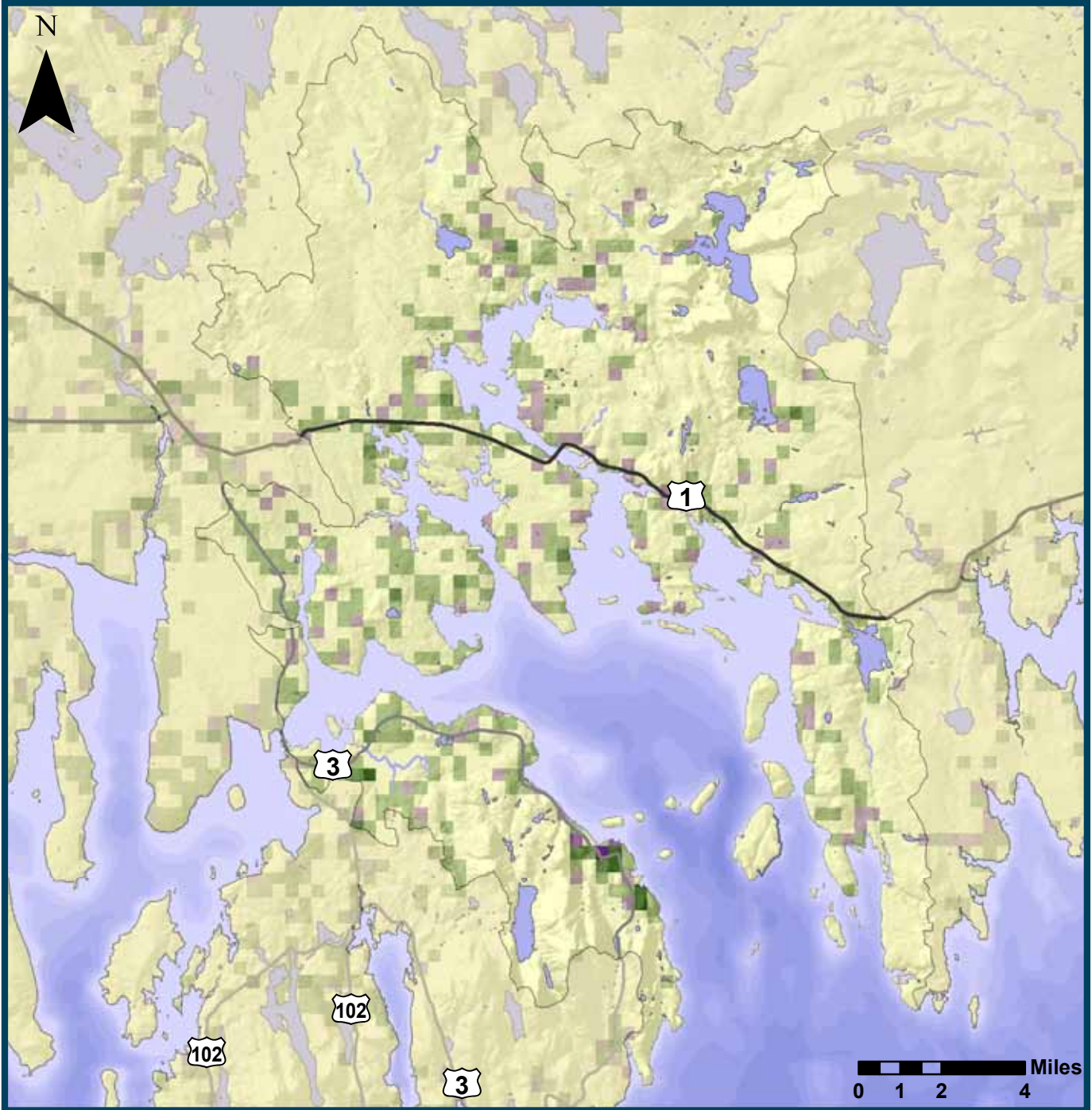
**Summary:** The goal of this map is to provide some general information on overall rates of development and locations of hotspots. The data are produced by the Maine State Planning Office by dividing the state into an array of 500m by 500m squares and then recording the number of residential and commercial electrical connections in each square at the beginning of every year going back to 1990. This makes it a simple process to estimate development rate on a fine scale. The dataset differentiates between residential and commercial connections, so it is possible to see changes on a more refined level by separating it into two maps instead of the one shown here. Although the statewide dataset goes back to 1990, no data for the Frenchman Bay watershed exists prior to 2004, so all that is displayed here is the change between 2004 and 2010.

From an initial glance at this map it is clear that some there are some areas, such as downtown Bar Harbor, that are hotspots of development, but there is also consistent growth across much of the map. The only areas that appear to be generally free of increased development are Acadia National Park and the inland areas in the North of the watershed.

## Data Sources

Development Tracking - State Planning Office/Maine Office of GIS -  
<http://www.maine.gov/megis/catalog/>

# Development Tracking



## Legend

Change in # of Connections	Color	Range
< -10	Dark Purple	< -10
-9 to -5	Medium Purple	-9 to -5
-4 to -1	Light Purple	-4 to -1
0	Light Yellow	0
1 to 4	Light Green	1 to 4
5 to 10	Medium Green	5 to 10
> 10	Dark Green	> 10

These data show the change in number of residential and commercial electrical connections between 2004 and 2010, which is one proxy for rate of development.

*Data Sources: Me Office of GIS,  
Me State Planning Office*

# Tourism

**Summary:** With just shy of two million overnight visitors to the Downeast/Acadia region in 2004 according to Maine Office Tourism data, it is clear that tourism is a powerful force in the Frenchman Bay area. The presence of Acadia National Park draws many of the visitors, but there are a number of other attractions that draw people to the water, such as whale watching, nature tours, and sea kayaking. The majority of visitors are drawn to Bar Harbor and Mount Desert Island, but the whole region has a major influx of visitors in summertime. The large tourism input represents a key part of the region's economy, but it also puts a large strain on the resources of the area, and can lead to user conflicts of an area such as concerns from fishermen about cruise ships and fixed fishing gear.

## Legend Description

**Scenic View Points-**The Hancock County Planning Commission and the Washington County Council of Governors conducted a survey to quantify the Downeast region's scenic locations, and these are the sites they considered to be important scenic views. Details of the process and more information on individual locations can be found at <http://www.hcpcme.org/environment/view/index.html>.

**Potential Recreational Kayak Routes-**These routes are based on interviews with local kayak guides, but do not represent an exhaustive survey of the bay. Recreational kayaking is difficult to track, because it does not tend to follow specific routes, so these data are just a best guess.

**Commercial Kayak Trips-**When this map was created there were three commercial kayak tour operators in Bar Harbor. This depicts the area in which they all commonly run tours.

**Cruise Ship Route/Anchorages-**In 2010, there were 120 visits to Bar Harbor by cruise ships, and this shows the routes they are required to take and locations they are required to anchor.

**Common Tour Boat Routes-**As of the time of writing there were at least 14 commercial tour boats operating in Frenchman Bay waters, ranging from a small Friendship sloop to the 140 ft. whale-watching catamaran. These data are common routes taken by the some of the tour boats as described by vessel captains.

## Data Sources

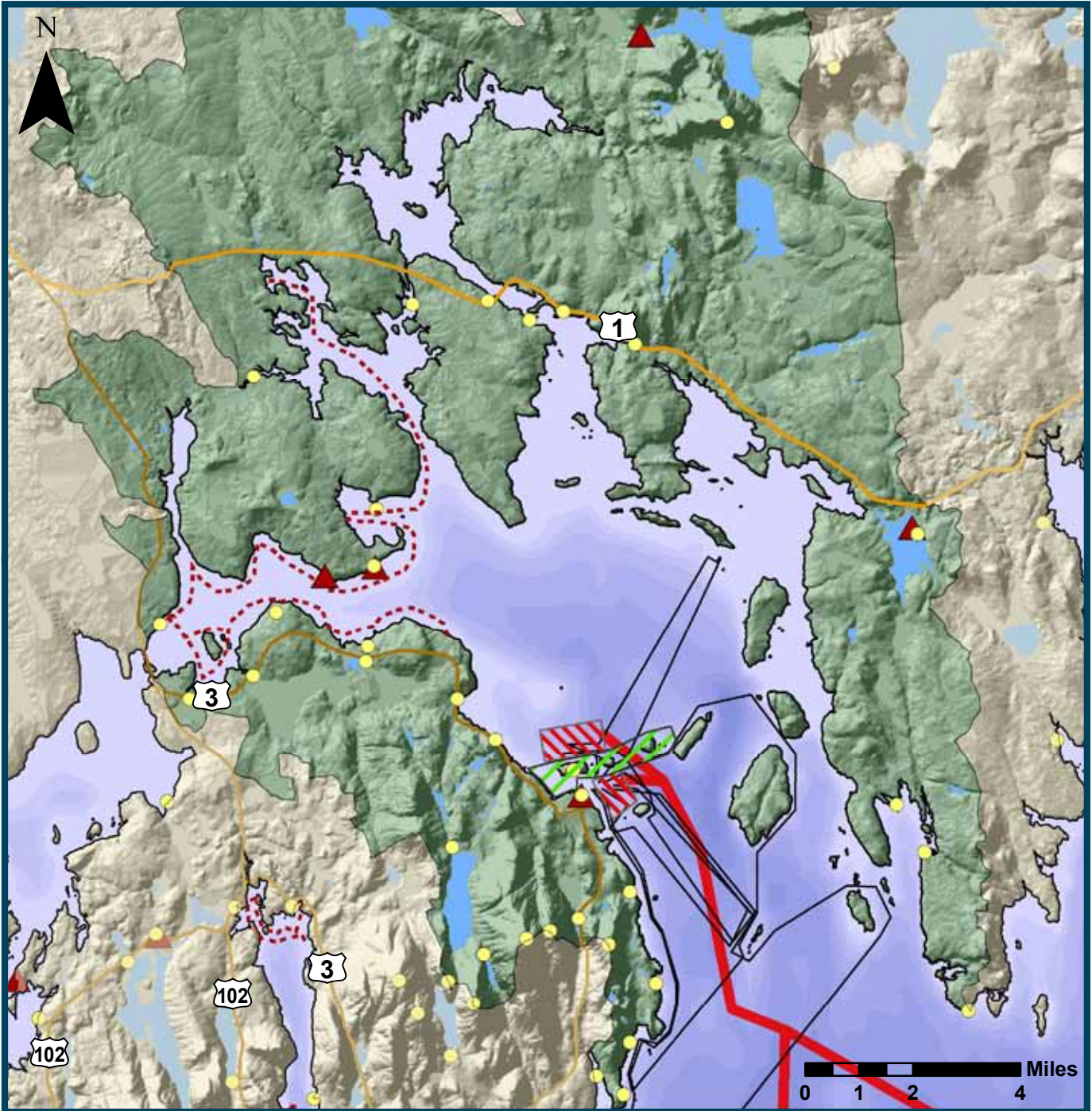
Scenic Viewpoints - Hancock County Planning Commission - <http://www.hcpcme.org/index.html>

Kayak Routes - College of the Atlantic - <http://coa.edu/gis-lab.htm>








Cruise Ship Routes - NOAA - <http://www.charts.noaa.gov/OnLineViewer/13312.shtml>

Tour Boat Routes - College of the Atlantic - <http://coa.edu/gis-lab.htm>

# Tourism



## Legend

- |   |   |
|---|---|
|  Commercial Kayak Trips              |  Cruise Ship Anchorages  |
|  Potential Recreational Kayak Routes |  Common Tour Boat Routes |
|  Public Boat Launches                |  Cruise Ship Routes      |
|  Scenic View Points                  |   |

*Data Sources: Me Office of GIS, Me State Planning Office,  
Hancock County Planning Commission,  
National Oceanic and Atmospheric Administration*

# Working Waterfront

**Summary:** Working waterfronts are simply the areas of the coast where commercial marine activity occurs, usually in the form of a pier or boatyard. Coastal access and working waterfronts are an important part of Maine coastal communities. With a high proportion of the state's economy based around the commercial fishing industry it is vital to keep open access to the sea. These areas are potentially under threat from developmental conversion either to private ownership that might not allow access or conversion of areas, such as from a working pier into a shorefront hotel. Understanding their locations is useful both for coordinating uses of the bay to ensure that conflicts of interest are avoided and more importantly for planning to ensure that working waterfront areas are maintained for the future.

The data presented here were gathered during a 2005 study by the Island Institute in an attempt to quantify the State's working waterfront areas. The study was prompted by the concern that the State's working waterfront areas were in danger of disappearing as the coastline becomes more developed and more of a tourist destination. Locations were acquired through a lengthy series of community interviews with community officials and resources users.

## Access Point Categories

**Public Mixed Use**-Sites where public access is permitted, and is accessed for a range of purposes. Can include public rights-of-way, boat launches and town wharfs.

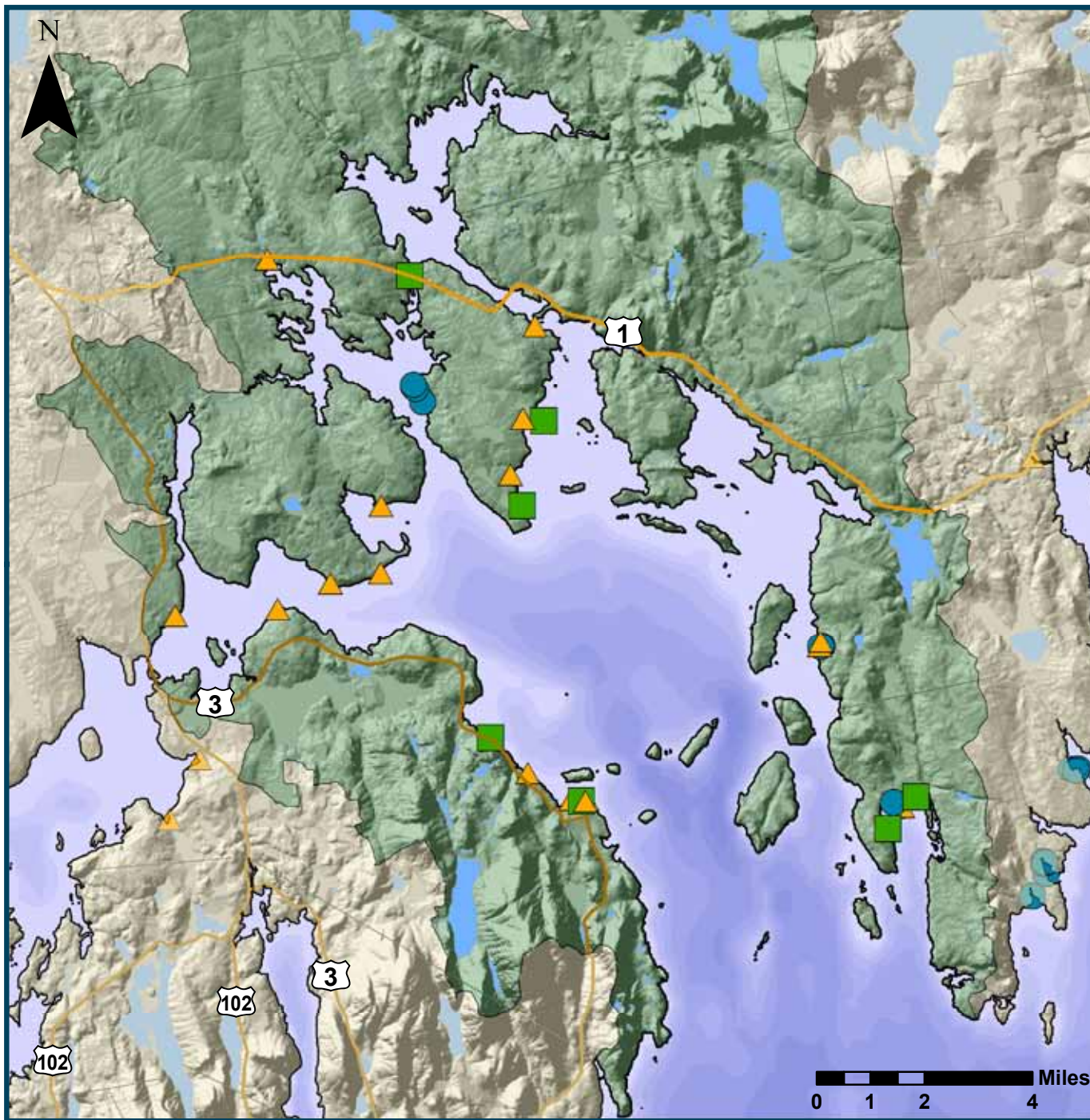
**Private Recreational**-Locations owned by private individuals or companies that provide access to the waterfront for non-commercial purposes. Most common variety is a marina.

**Private Commercial**-Privately owned locations that support commercial water access, most commonly in the form of commercial fishing. These can include lobster pounds and coops along with boatyards and other similar locations.

## Data Sources

Working waterfront sites-Island Institute-<http://www.islandinstitute.org/> (Home page)  
[http://www.islandinstitute.org/working\\_waterfront\\_access.php](http://www.islandinstitute.org/working_waterfront_access.php) (Project page)

# Working Waterfront/Coastal Access



## Legend

- ▲ Public Mixed Use
- Private Recreational
- Private Commercial

Data Sources: Me office of GIS, Island Institute

# Conserved Lands

**Summary:** The region surrounding Frenchman Bay has a particularly large proportion of conserved land, largely through the presence of Acadia National Park, though there are also a number of land trusts and state land that cover appreciable portions of the watershed. Aside from the park, the most prominent is the land surrounding Donnell Pond and Schoodic Mountain that is held by the state, which is a popular camping spot.

Conserving land serves a wide range of purposes. What initially comes to the minds of many people is the protection of habitat. They can also act as important sites for recreation in the form of hiking, camping, fishing, and hunting, depending on how the lands are conserved. These lands also act as important sites for research on animals and plants in a relatively undisturbed habitat.

When discussing conserved land, it is important to be clear about how it has been conserved, because conserved lands is a general term that can have different meanings for different parcels of land. A land with an easement on it will be protected under the terms of that easement permanently, but land that is just owned by a government agency or land trust with no easement does not necessarily have any long-term protection.

This map may not represent the most up to date status of lands, so it is important to always contact the landowner before attempting to access any of the parcels displayed on the map.

## Legend Description

**Downeast Sunrise Trail**-An 85 mile, multi-use trail built on old railbeds by several state agencies.

**Conservation Easements**- Areas where the landowner has given up the rights to development, either totally or to varying degrees, and an external organization, such as a federal/state agency or a land trust, who is responsible for enforcing the terms of the easement in perpetuity.

## Data Sources

National Park Service Land - US National Park Service -

<http://www.nps.gov/acad/index.htm> (Homepage)

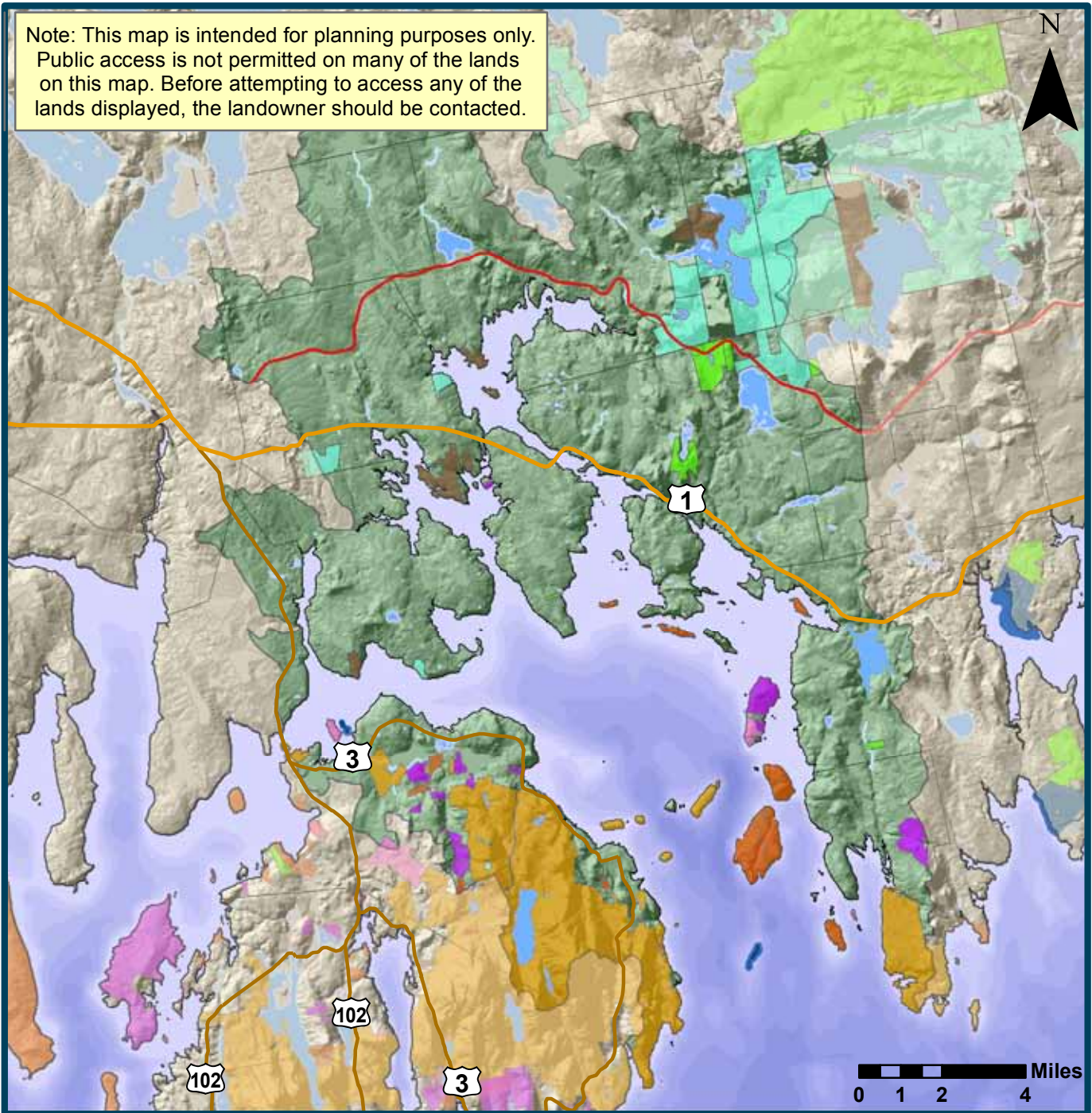
<http://irma.nps.gov/App/Reference/Search> (Data)

Maine Coast Heritage Trust - Maine Coast Heritage Trust - <http://www.mcht.org/>

Other Conserved Lands - Maine Office of GIS - <http://www.maine.gov/megis/catalog/>

# Conserved Lands

Note: This map is intended for planning purposes only. Public access is not permitted on many of the lands on this map. Before attempting to access any of the lands displayed, the landowner should be contacted.



## Legend

- |  |  |
|--|--|
| <span style="color: red;">■</span> Downeast Sunrise Trail        | <span style="color: orange;">■</span> National Park Service Land                       |
| <span style="color: brown;">■</span> State Conservation Easement | <span style="color: darkorange;">■</span> National Park Service Conservation Easement  |
| <span style="color: cyan;">■</span> State-Owned Land             | <span style="color: purple;">■</span> Maine Coast Heritage Trust Conservation Easement |
| <span style="color: blue;">■</span> Federally-Owned Land         | <span style="color: pink;">■</span> Maine Coast Heritage Trust Land                    |
| <span style="color: green;">■</span> Private Land Trust          |  |

Features outside of the Frenchman Bay Watershed are greyed out slightly to emphasize the watershed.

Data Sources: Maine Coast Heritage Trust, US National Park Service, Me Office of GIS

# William Procter's Survey

**Summary:** Between 1926 and 1932, William Procter conducted a lengthy survey of the Mount Desert Island region. The survey primarily consisted of a number of subtidal and intertidal sites, though he also did lengthy fieldwork on insects on the island. His subtidal sites were sampled using a small dredge and samples were processed partially onboard the vessel and partially in his shoreside laboratory. A lengthy report detailing his methodology and results can be found online at: <http://archive.org/details/biologicalsurvey0205proc>

This map presents the sites that he conducted shore and dredge surveys along with the bottom types that he reported from his survey. The map of bottom type was presented separately from the dredge station data, and it is unclear how he collected these data. At times the description of the dredge station does not appear to match with the bottom type listed on the map of bottom type.

In his report, Procter presented a list of species along with the stations they were found at, so some reverse engineering was necessary to be able to create species lists for each station. That work has been done and was significantly assisted by the Maine Natural History Observatory's production of a catalog of the species found during the survey. About 50 out of the almost 700 species reported were not given accurate station lists, usually because they were quite common, so the data needs to be used carefully in order to best characterize the dataset that Procter collected.

Exhaustive surveys such as these are the cornerstone of conservation planning; historical data have the potential to provide unique insights when setting conservation and restoration goals. A replication of Procter's work would present an interesting historical comparison, and a group of scientists (C. Wray, MDIBL, G. Mittelhauser, Maine Natural History Observatory and C. Petersen, COA) are currently in the early stages of planning such a comparison. It is of particular interest, because the original work was conducted before the introduction of the green crabs (*Carcinus maenus*) to the region, so a comparison particularly with the intertidal and shallow subtidal sites could tell an interesting story about the ecological impact of that invasive crab.

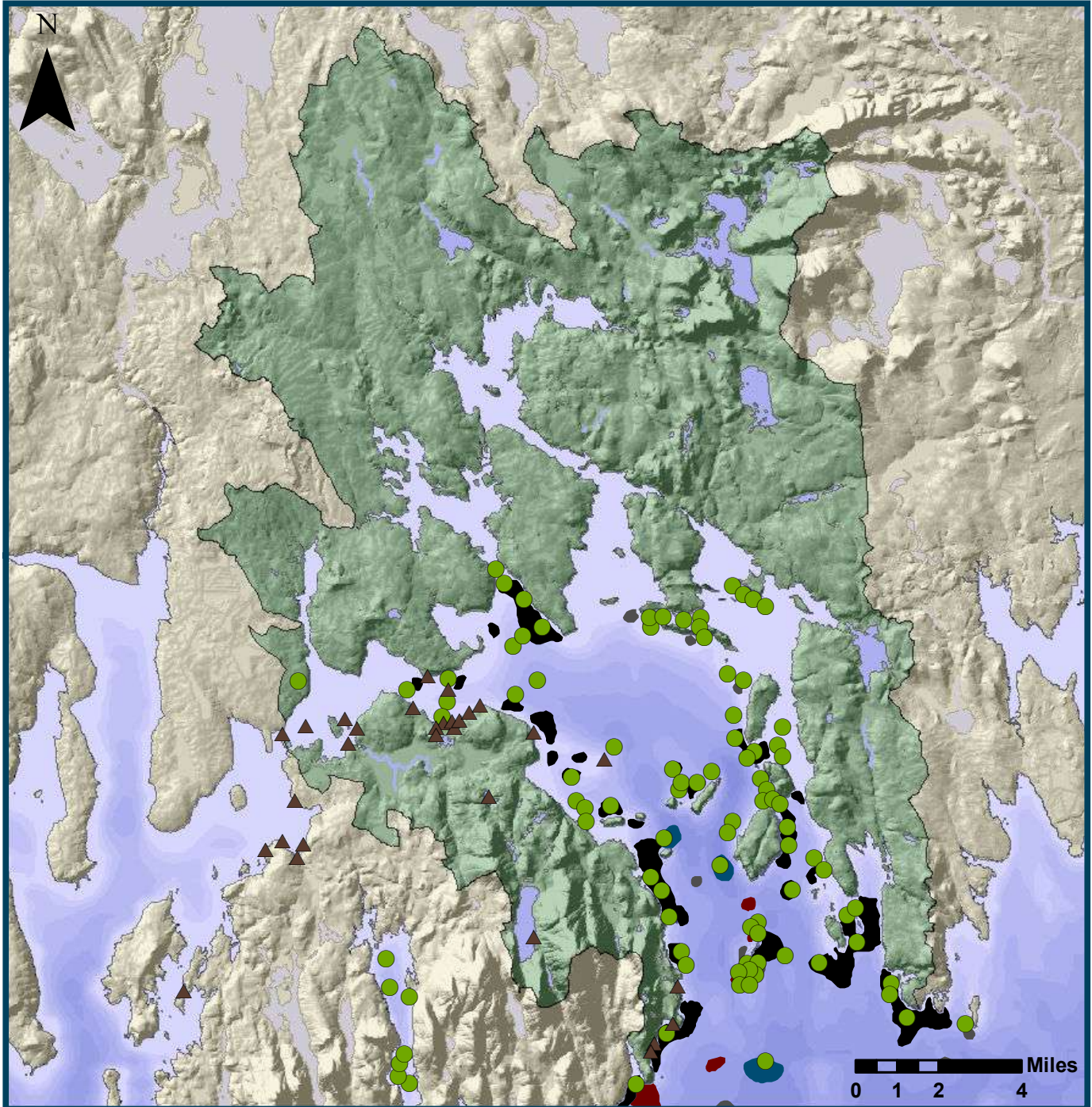
## Data Sources

William Procter's Survey Sites - College of the Atlantic -

<http://coa.edu/gis-lab.htm>

<http://archive.org/details/biologicalsurvey0205proc> (Original report)

# William Procter's Survey 1926-1932



## Legend

- |                    |                |
|--------------------|----------------|
| ● Dredge Stations  | ■ Blue Clay    |
| ▲ Shore Stations   | ■ Gravel/Shell |
| <b>Bottom Type</b> | ■ Hard         |
| ■ Rocky            | ■ Soft         |

These are the stations visited during William Procter's survey work between 1926 and 1932.

*Data Sources: Maine Office of GIS  
College of the Atlantic  
Maine Natural History Observatory*



# Section 4: Synthesis

This collection of maps highlights areas of potential environmental concern in the Frenchman Bay Watershed.

# Point Source Pollution

**Summary:** Understanding the locations of point source pollution is an important initial step in studying the health of a watershed. Regions with a high concentrations of pollution sources can represent threats to public health, particularly if they are located in close proximity to public beaches, aquifers or public water supplies. The presence of an active OBD or CSO is cause to close an area to clam harvesting due to the potential for fecal contamination.

**Wastewater Emitters/Outfalls**-Facilities that are licensed by the Maine DEP to discharge wastewater. Wastewater can consist of a number of different substances including treated municipal waste, aquatic pesticides, and aquaculture discharge. A more complete list is available from:

<http://www.maine.gov/dep/water/permits/index.html>

**Combined Sewer Overflows (CSOs)**-Locations where untreated wastewater and stormwater is discharged during heavy rain events. Since raw waste is discharged into ocean water, there are a number of potential health issues with CSOs, and Maine DEP is currently requiring communities to take steps towards their abatement. More information is available at: <http://www.maine.gov/dep/water/cso/index.html>

**Air Pollutant Emitters**-Facilities licensed by the Maine DEP to discharge certain air pollutants. Pollutants include, but are not limited to dust, fumes, gas, mist, particulate matter, smoke, and vapor. More information is available at: <http://www.maine.gov/dep/air/permits/index.html>

**Overboard Discharges (OBDs)**-Sites where discharge of sanitary wastes or wastewater has been grandfathered into acceptance by the DEP because of the difficulty of connecting to a public system or a septic tank. More information is available from: [http://www.maine.gov/dep/water/wd/OBD/ip\\_obd.pdf](http://www.maine.gov/dep/water/wd/OBD/ip_obd.pdf)

**Significant Aquifers**-Areas of rock or loose materials, such as gravel or sand, from which water can be extracted in significant quantities. Understanding their location in relation to pollution sources is key for monitoring groundwater health.

## Data Sources

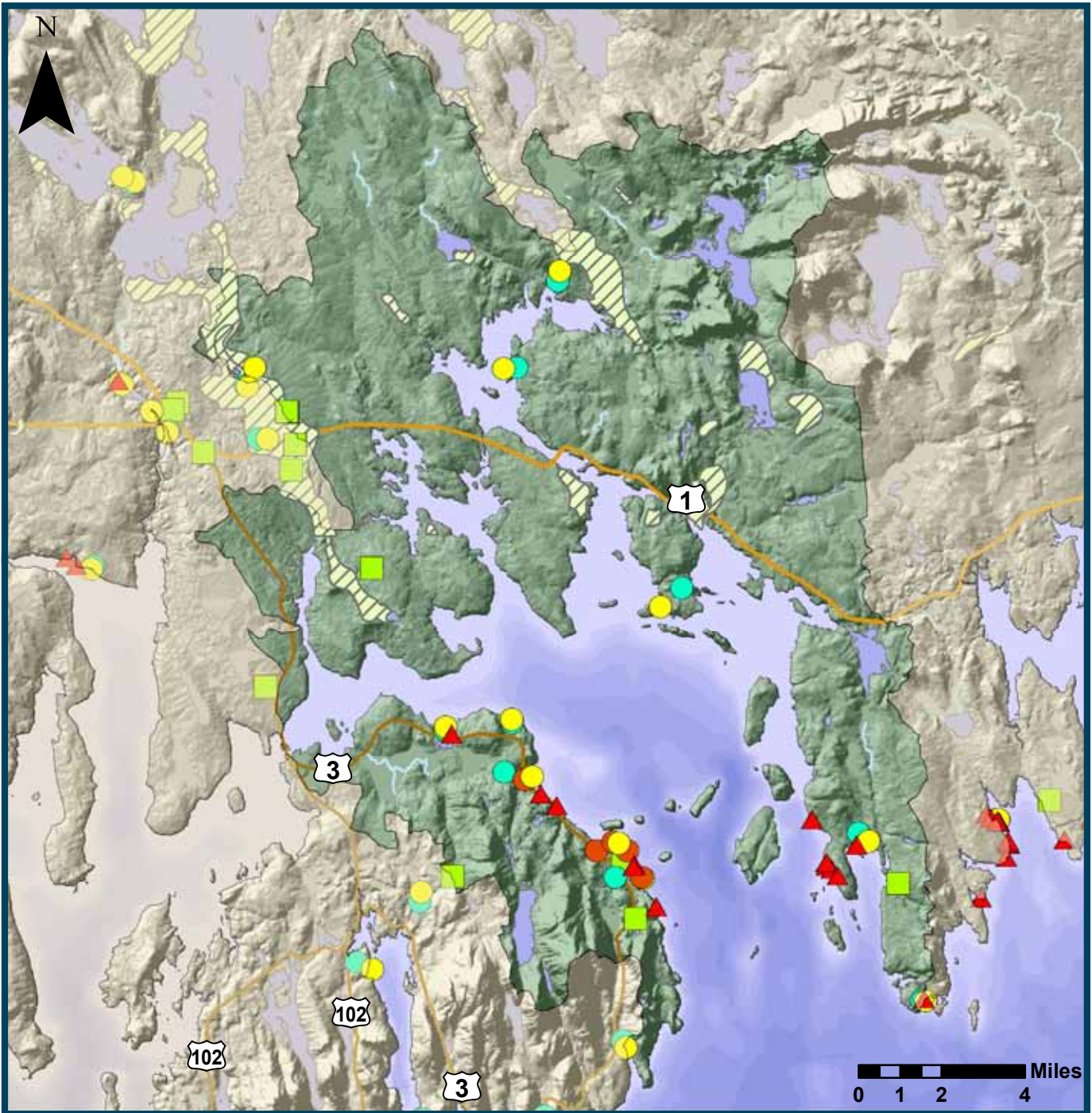
Overboard Discharges - Maine DEP - <http://www.maine.gov/dep/gis/index.html>

Wastewater Facilities - Maine DEP - <http://www.maine.gov/dep/gis/index.html>

Air Pollutant Emitters - Maine DEP - <http://www.maine.gov/dep/gis/index.html>

Significant Aquifers - Maine Office of GIS - <http://www.maine.gov/megis/catalog/>

# Point Source Pollution



## Legend

- ▲ Overboard Discharge
- Wastewater Outfall
- CSO
- Wastewater Discharge Facilities
- Licensed Air Pollution Emitters
- ▨ Significant Aquifers

Data Sources: Me Office of GIS  
Me Department of Environmental Protection

# Overboard Discharges 1995-2012

**Summary:** The passing of the Clean Water Act in 1972 banned straight pipe discharges, where raw sewage was dumped directly from residences into waterbodies. Over the next decade, the Maine DEP worked with property owners to remove their straight discharges, either through installing a septic system or by connecting to the municipal waste service. Some situations made these solutions impractical, such as when the terrain was unsuitable for a septic field or the distance to the municipal sewer system was too great. For these particular situations, an overboard discharge (OBD) was installed.

An overboard discharge is essentially just a small scale version of a municipal wastewater treatment plant that filters out harmful bacteria and pollutants. However, the risk of a malfunction is still significant enough that the presence of an OBD is sufficient cause to close clam flats in the area to harvesting. The removal of OBDs and straight pipe discharges is important for maintaining harvestable clam flats.

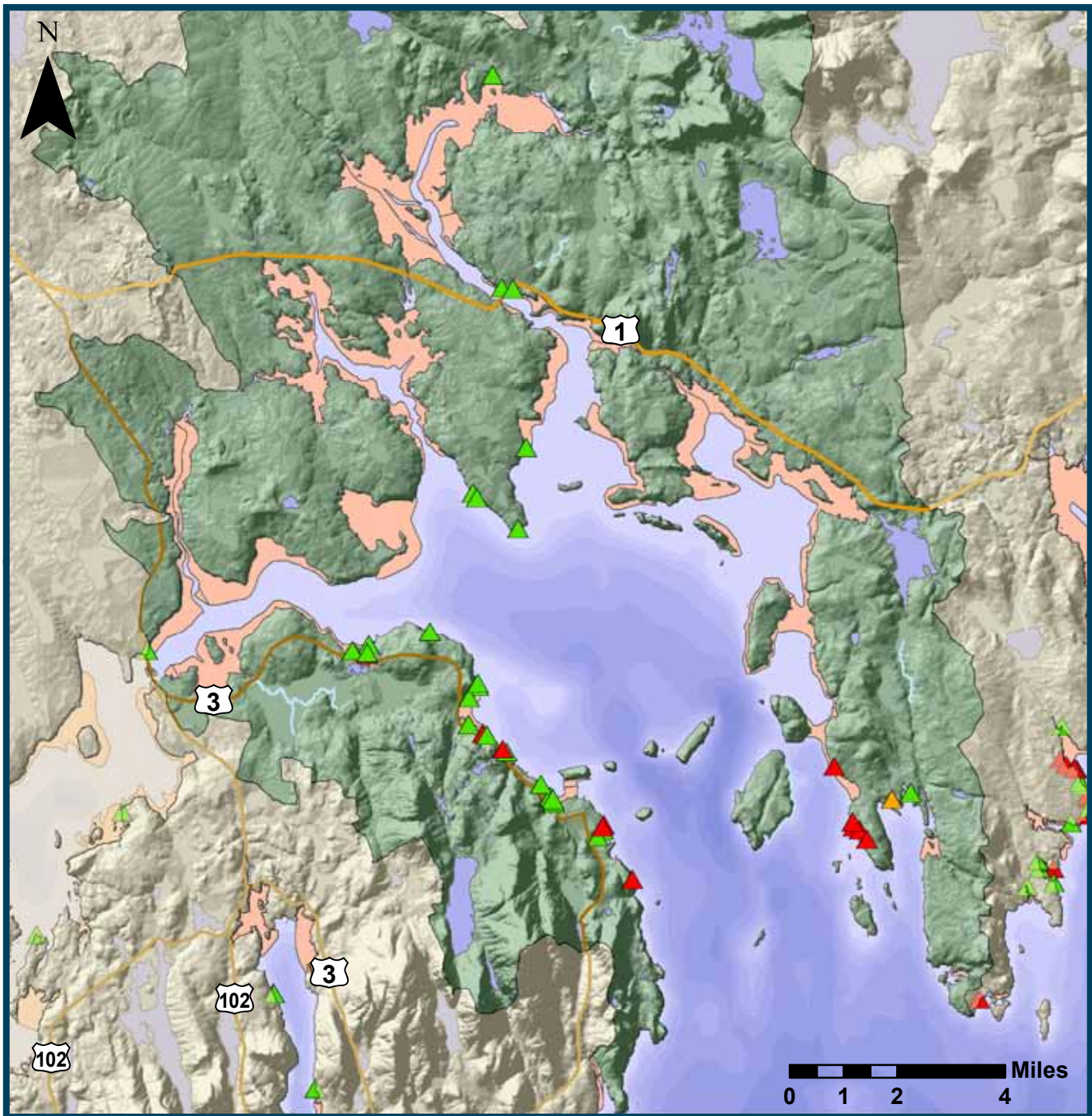
This map displays a portion of the reduction in OBDs, however records on locations of OBDs before 1995 were inaccessible, so what is displayed here is the change between 1995 and the time of writing (March, 2012). Statewide, there were less than half the number of OBDs operating in 2010 than there were in 1987, and that number doesn't include all the straight pipe discharges that were operating when the clean water act was passed. It is clear that there has been a sizeable reduction in the number of OBDs, though the exact nature of that reduction remains unclear.

More information about OBDs can be found on the Maine DEPs website:  
[http://www.maine.gov/dep/water/wd/OBD/ip\\_obd.pdf](http://www.maine.gov/dep/water/wd/OBD/ip_obd.pdf)

## Data Sources

Overboard Discharges - Maine DEP - <http://www.maine.gov/dep/gis/index.html>

# Overboard Discharges 1995-2012



## Legend

- ▲ Removed Overboard Discharge
- ▲ Inactive Overboard Discharge
- ▲ Active Overboard Discharge
- Softshell Clam Habitat

Data Sources: Maine Office of GIS  
Maine DEP, Maine DMR

# Shellfish Closures

**Summary:** Harvesting closures resulting from bacterial pollution are a major problem for shellfish harvesters in the upper bay area. Bacterial closures can result from obvious factors such as overboard discharges and combined sewer overflow, but other, less immediately apparent factors, such as leaky septic tanks, can release significant quantities of harmful bacteria that make the shellfish unsafe to eat. In addition, fecal contamination from warm-blooded wildlife or agricultural animals is also capable of raising bacteria counts and causing shellfish closures. Many of these areas are dynamic and can change through time, so this map should not be used to determine safe locations for clamming. Calling the town harbormaster or going to the Maine Department of Marine Resources website are the best ways to determine when and where it is safe to harvest shellfish in the bay.

**Wastewater Outfall**-Wastewater can consist of a number of different substances including treated municipal waste, aquatic pesticides, and aquaculture discharge. A more complete list is available from: <http://www.maine.gov/dep/water/permits/index.html>

**Combined Sewer Overflow**-Locations where untreated wastewater and stormwater is discharged during heavy rains. More information is available at: <http://www.maine.gov/dep/water/cso/index.html>

**Overboard Discharge**-Sites where discharge of sanitary wastes or wastewater has been grandfathered into acceptance by the DEP because of the difficulty of connecting to a public system or a septic tank. More information is available from: [http://www.maine.gov/dep/water/wd/OBD/ip\\_obd.pdf](http://www.maine.gov/dep/water/wd/OBD/ip_obd.pdf)

**Softshell Clam Habitat**-Areas classified as habitat as softshell clam habitat during a 2007 survey by Maine DMR: [http://www.maine.gov/dmr/rm/public\\_health/2009molluscanmapping.pdf](http://www.maine.gov/dmr/rm/public_health/2009molluscanmapping.pdf).

**Shellfish Closure Areas**-All shellfish growing areas in the state have undergone a sanitary survey to classify whether it is safe to harvest shellfish. More information about the survey can be found on the Maine DMR website: [http://www.maine.gov/dmr/rm/public\\_health/howclassified.htm](http://www.maine.gov/dmr/rm/public_health/howclassified.htm).

**Conditionally Approved**-Harvesting is allow, but only under certain conditions.

**Conditionally Restricted**-Permitted harvesting for the purposes of depuration or relay is allowed only under certain conditions.

**Restricted**-Permitted harvesting for the purposes of depuration or relay is allowed.

**Prohibited**-No harvesting is allowed for any purpose.

## Data Sources

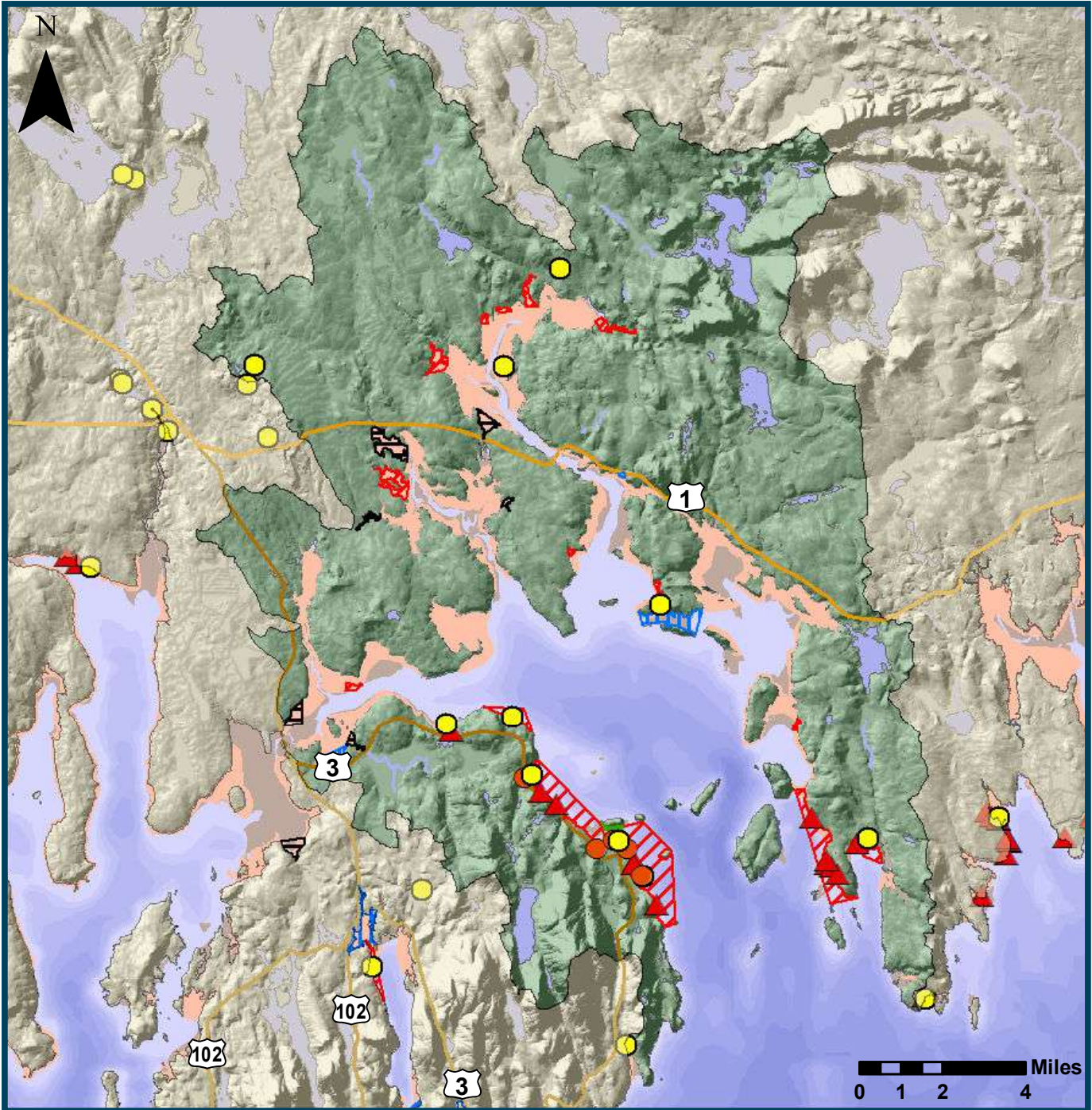
Overboard Discharges - Maine DEP - <http://www.maine.gov/dep/gis/index.html>

Wastewater Outfalls/CSOs - Maine DEP - <http://www.maine.gov/dep/gis/index.html>

Softshell Clam Habitat - Maine DMR/Maine Office of GIS - <http://www.maine.gov/megis/catalog/>

Shellfish Closure Area - Maine DMR - [http://www.maine.gov/dmr/rm/public\\_health/closures/closedarea.htm](http://www.maine.gov/dmr/rm/public_health/closures/closedarea.htm)

# Shellfish Closures



## Legend

- |                                |                         |
|--------------------------------|-------------------------|
| <b>Shellfish Closure Areas</b> | Wastewater Outfall      |
| Conditionally Restricted       | Combined Sewer Overflow |
| Conditionally Approved         | Overboard Discharges    |
| Restricted                     | Softshell Clam Habitat  |
| Prohibited                     | Mudflats                |

Closures are up to date as of March, 2012.  
Consult with MEDMR for current closures.

*Data Sources: Me Office of GIS,  
Maine Department of Marine Resources*

# PSP Closures and Aquaculture

**Summary:** Red tide events are caused by blooms of phytoplankton that release toxins that can accumulate in seafood and pose a health risk to humans. The most common species is *Alexandrium funydense* and the toxin it releases causes paralytic shellfish poisoning (PSP). Other, less common species, are responsible for amensic shellfish poisoning (ASP) and diarrhetic shellfish poisoning (DSP).

Due to the large health risk, the Maine Department of Marine Resources monitors level of biotoxins throughout the year and issues closures to shellfish harvesting when dangerous levels are detected. More detail about the monitoring methodology and other aspects of the biotoxin monitoring program can be found at: [http://www.maine.gov/dmr/rm/public\\_health/biotoxinmonitoring.htm](http://www.maine.gov/dmr/rm/public_health/biotoxinmonitoring.htm)

## Legend Description

**Aquaculture Sites-** Aquaculturists are going to prefer to locate their sites in areas that are closed as infrequently as possible so as not to interfere with their harvesting. As this map shows, this can lead to an increased pressure on the upper bays to shellfish aquaculture, because of their lowered susceptibility to red tide events. These data were digitized off digital maps on the Maine Department of Marine Resources website: <http://www.maine.gov/dmr/aquaculture/leaseinventory/index.htm>

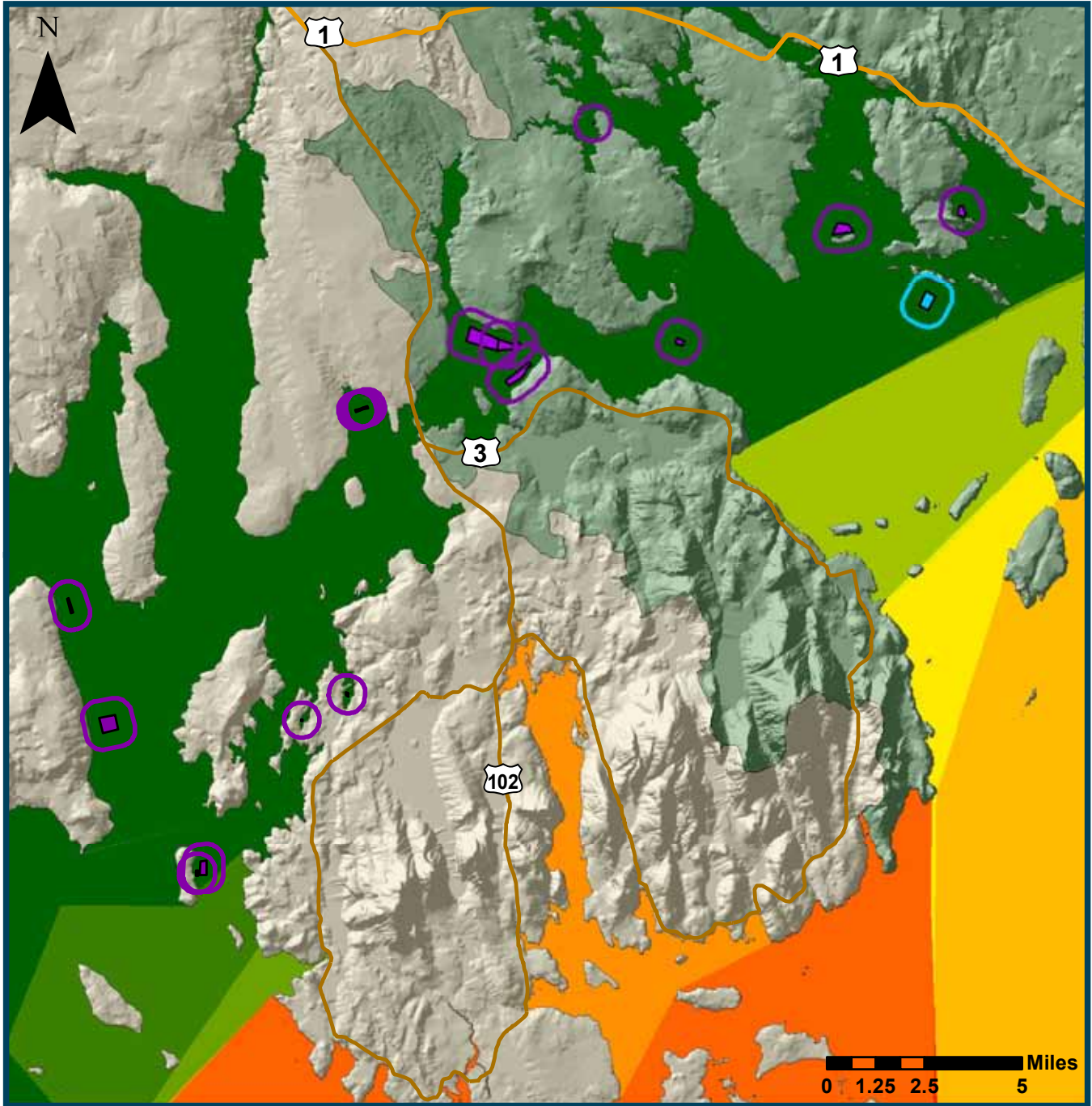
**Red Tide Closures-** The closure data for this map spans the period from 2000 to 2012, and closures were summed and averaged to produce an average number of days closed per year. Data were digitized from paper legal notices obtained from the Maine DMR office in Hallowell, Maine.

## Data Sources

Aquaculture Sites - Maine DMR - <http://www.maine.gov/dmr/aquaculture/leaseinventory/index.htm>

Red Tide Closures - Maine DMR - <http://www.maine.gov/dmr/index.htm>

# Red Tide Closures 2000-2011



**Average Days Closed Per Year**

- 3 - 10
- 11 - 16
- 17 - 23
- 24 - 30

**Aquaculture Sites**

- 31 - 37
- 38 - 44
- 45 - 51
- 52 - 60
- 61 - 72
- 73 - 80
- Finfish
- Shellfish

Buffers have been created around aquaculture sites to improve map legibility.

Values represent the average number of days closed per year over the time from January 2000 to January 2012

# Upper Bay Currents

**Summary:** Surface current flow plays an important role in the ecology of Frenchman Bay. Eelgrass seeds and invertebrate larvae are all transported by current flow. Thus, studying current patterns can aid in understanding ecosystem dynamics in the bay.

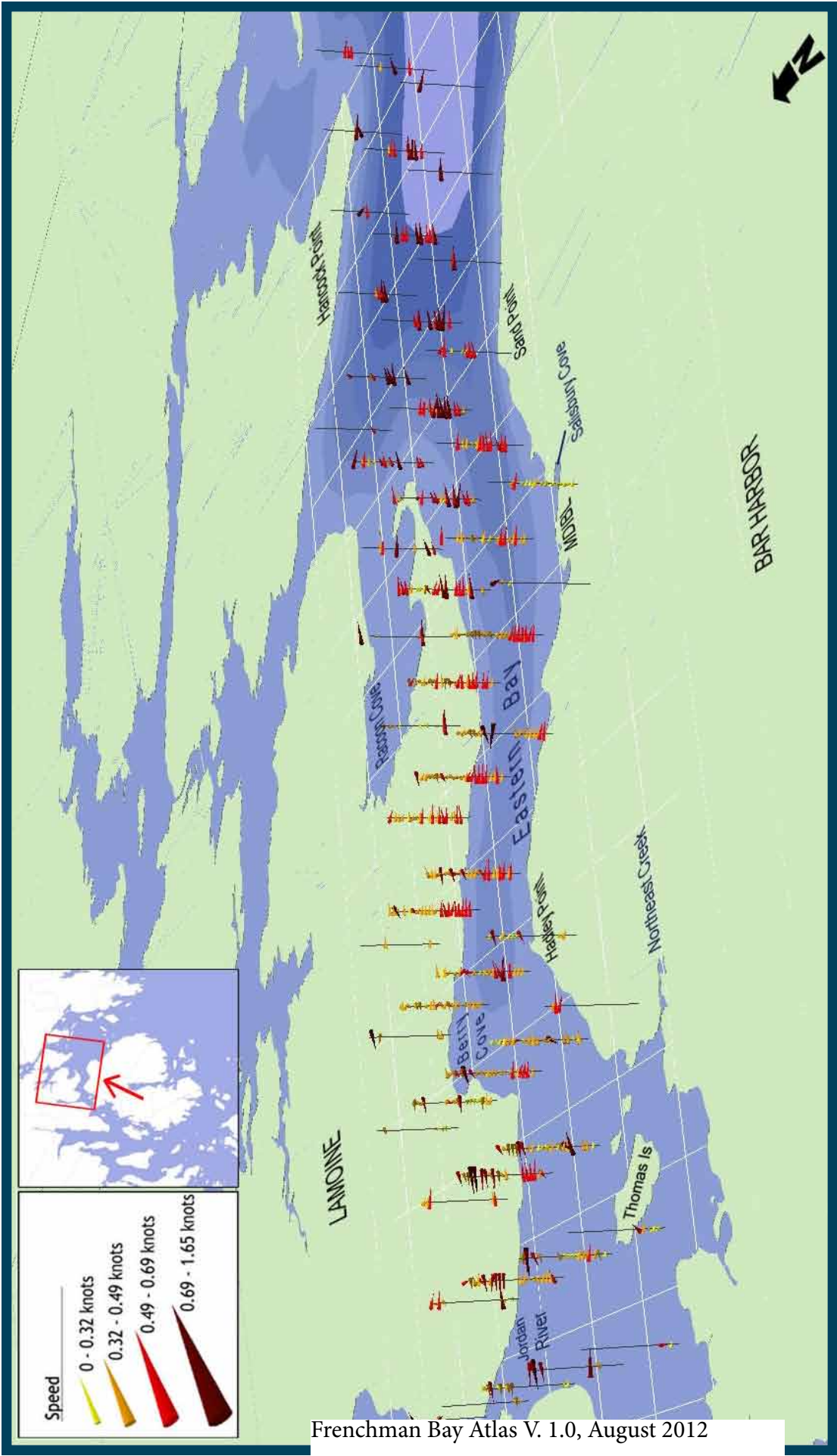
Another important organism that relies on currents for distribution is the red tide-inducing phytoplankton *Alexandrium fundyense*. *Alexandrium* cysts can lie dormant in offshore sediments for several years before germinating under appropriate environmental conditions. After germination, the plankton will begin to reproduce and if carried inshore under the right conditions, they can cause an outbreak of paralytic shellfish poisoning (PSP). One explanation for the fact that upper Frenchman Bay has remained relatively safe from PSP closures (see red tide closures map) is the current flow out of the upper bay. This map shows that there appears to be a generally consistent outflow from the upper bay area, which could block *Alexandrium* cells from entering.

These data were gathered using one or two drift buoys deployed daily that reported GPS locations every two minutes. The data were then averaged across the squares displayed on the adjoining map and then by then time after high tide to create the flow rates displayed. More information will be available from:

Kidder, G.W. III and H. Rowan, 2012. Surface currents in Eastern Bay a dispersal mechanism for eelgrass (*Zostera marina*) seeds. Bull Mt. Desert Isl. Biol. Lab. 51: (In review)

## Data Sources

Currents - Mount Desert Island Biological Laboratory - [http://www.mdibl.org/faculty/George\\_W\\_Kidder\\_III/127/](http://www.mdibl.org/faculty/George_W_Kidder_III/127/)



Frenchman Bay Atlas V. 1.0, August 2012

**Legend**

Current flow rates and directions for upper Frenchman Bay.

Current is flowing in direction of cone tip.

Height of cone on line represents time after high tide, from the top (0) to the bottom (12.5).

Cones plotted above land represent the data for the water contained within that rectangle.

Data Source: Mount Desert Island Biological Laboratory

Map Authors: George Kidder and Hope Rowan, MDIBL  
March, 2012

# Diadromous Fish Distribution

**Summary:** Diadromous fishes include fishes that migrate to freshwater to spawn (anadromous fish) and those that migrate to the ocean to spawn (catadromous fish). They play an important ecological role transferring energy between riverine and oceanic ecosystems. Historically they have also been harvested by humans for a range of purposes including, food, bait, and fertilizer, due to their high seasonal abundance. They are highly vulnerable to human activities, particularly to disturbances in their migratory routes along rivers. Dams and culverts are the most visible threats and can cut off fish passage altogether, preventing fishes from reaching upstream spawning areas. Other potential threats include degraded water quality and fishing mortality, either as the target species or as bycatch.

The data presented on this map are the product of a 2007 survey by the US Fish and Wildlife Service. The survey consisted of a review of existing and historic maps of diadromous fish distribution and consultations with local fishermen, fishing guides, and scientists from state and federal agencies. A variety of technical reports and scientific journal articles were also consulted during the process. Data for individual species were joined to the National Hydrography Dataset in order to create the sum data displayed here.

The map reports numbers of species in each segment of freshwater, as well as the location of current dams. The twelve species of diadromous fish in the state of Maine presented on this map are: alewives (*Alosa pseudoharengus*), blueback herring (*Alosa aestivalis*), rainbow smelt (*Osmerus mordax*), striped bass (*Morone saxatilis*), American eel (*Anguilla rostrata*), Atlantic sturgeon (*Acipenser oxyrinchus*), shortnose sturgeon (*Acipenser brevirostrum*), Atlantic tomcod (*Microgadus tomcod*), American shad (*Alosa sapidissima*), Atlantic salmon (*Salmo salar*), sea lamprey (*Petromyzon marinus*) and sea-run brook trout (*Salvelinus fontinalis*). Of those, the blueback herring, American shad, sea lamprey, and Atlantic salmon were not reported to have occurred historically in any of the waterways in the Frenchman Bay Watershed in this database.

More information on individual species can be found on the Maine Department of Marine Resources website at: <http://www.maine.gov/dmr/rm/speciesinformation.htm> or from the Fishes of the Gulf of Maine by Bigelow and Schroeder available at: <http://www.gma.org/fogm/>

## Data Sources

National Hydrography Dataset - USGS -

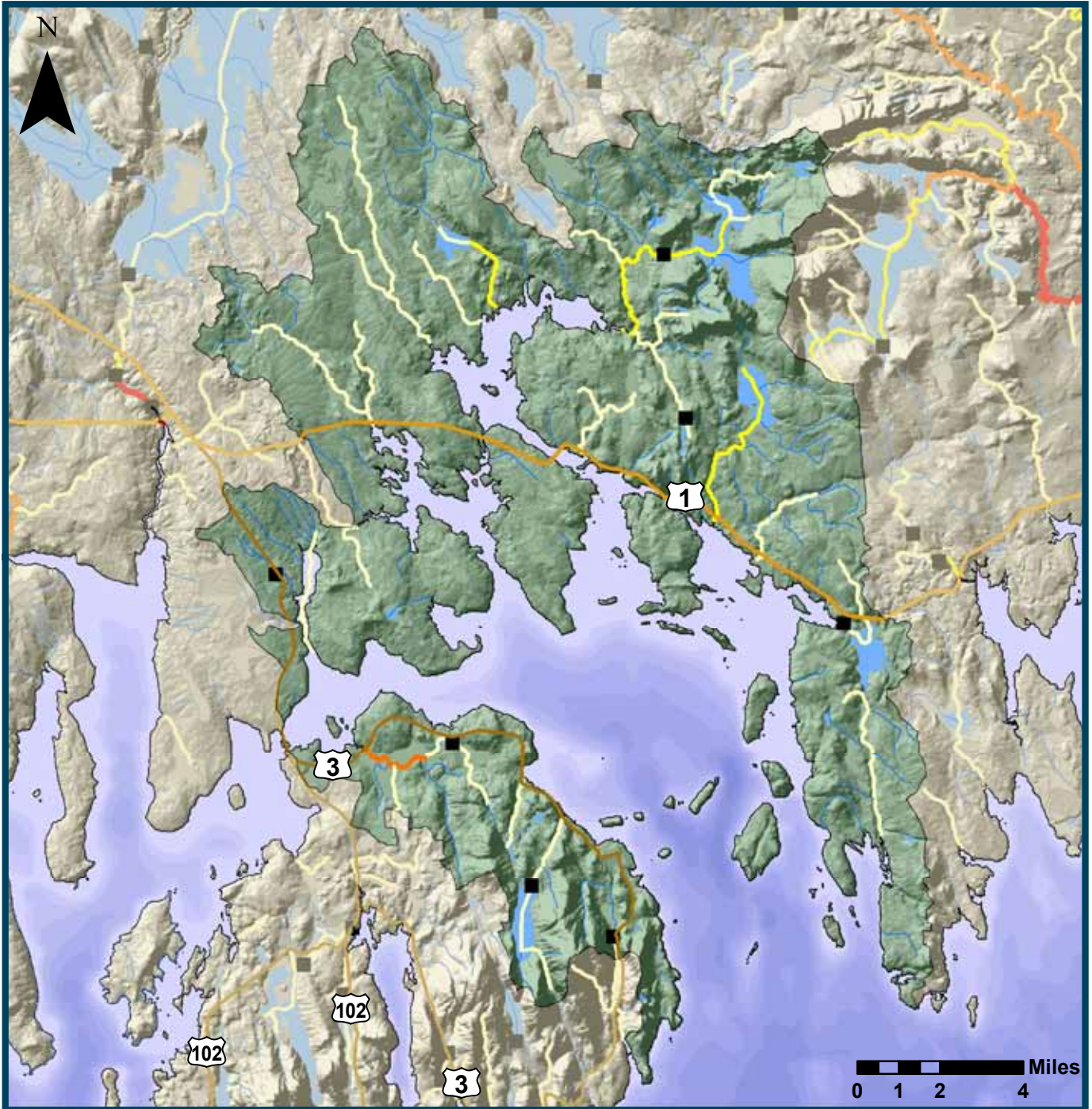
<http://nhd.usgs.gov/> (Homepage)

<ftp://nhdftp.usgs.gov/DataSets/Staged/States/FileGDB/MediumResolution/> (Data)

Diadromous Fish Distribution - USFWS - <http://www.fws.gov/GOMCP/identify.html>

Dams(Impoundments) - Me Office of GIS - <http://www.maine.gov/megis/catalog/>

# Current Diadromous Fish Distribution



## Legend

- Dams
- 3-4
- 5-6
- 7-8
- 9-11
- 0
- 1-2

*Data Sources: Maine Office of GIS,  
US Fish and Wildlife Service, US Geological Survey*

# Historic Diadromous Fishes

**Summary:** The two maps reproduced here represent the number of diadromous species that were reported for each stream historically and the number of species lost (historical minus current species). The data are reported for sections of streams, called stream segments, and so the number of species historically present or lost may change over a stream or river. These maps suggest that for the smaller streams that are typical of Frenchman Bay, the loss of species is relatively low, especially when compared with the larger nearby rivers.

Most freshwater streams leading into Frenchman Bay are relatively small and have from 1- 3 species of anadromous fish (alewives, rainbow smelt, and sea-run brook trout are most common) and 1 species of catadromous fish (American Eel). By contrast, nearby watersheds that have larger river systems have historically had more species. All twelve of the diadromous fish species present in Maine (see current diadromous fish distribution map) were historically found in the larger river systems to the west and east, the Union and Narraguagus Rivers.

Historical data must always be considered carefully, since the lack of data could just as easily mean that everyone forgot that there were fishes as that there were never any fishes at all. In addition, the dataset behind this map was gathered across the entire Gulf of Maine watershed, and while it represents a monumental effort and the most complete study of its kind for the area, it still may need some groundtruthing when considered at the fine scale of the Frenchman Bay watershed. Thus, the following two maps should be thought of as an initial overview that follow up research will help to verify.

## Data Sources

National Hydrography Dataset - USGS -

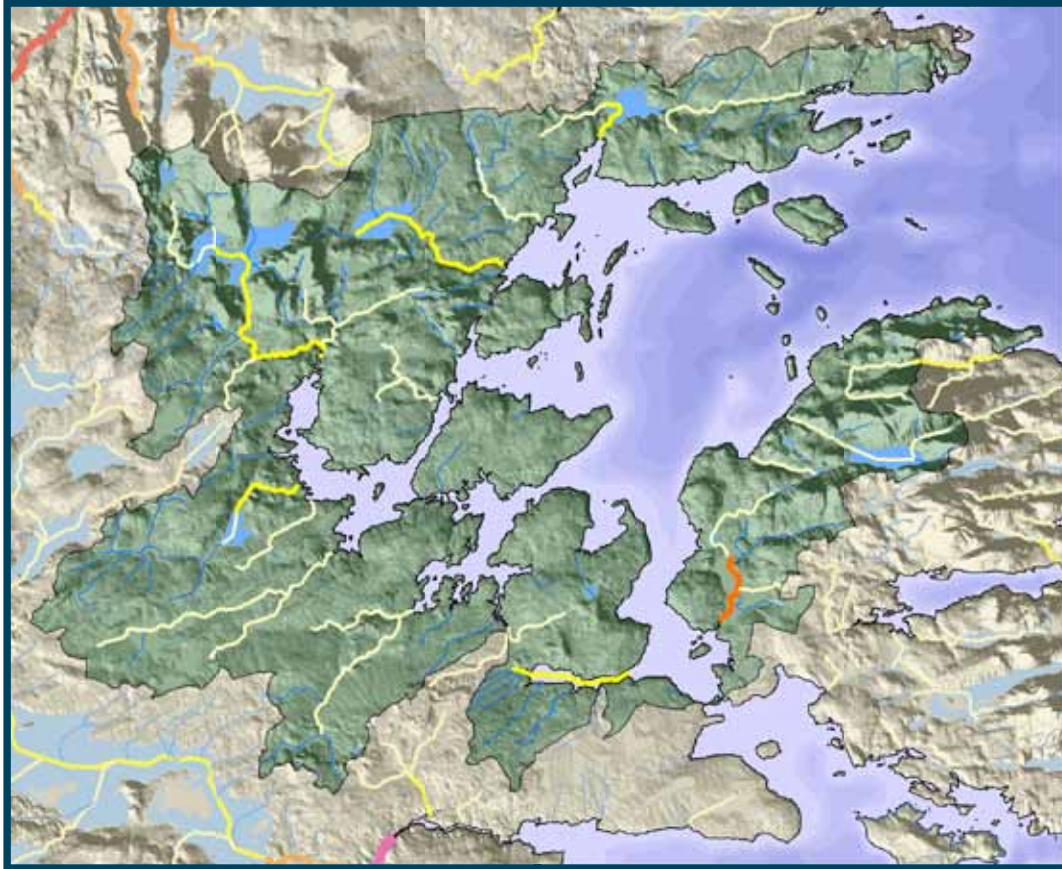
<http://nhd.usgs.gov/> (Homepage)

<ftp://nhdftp.usgs.gov/DataSets/Staged/States/FileGDB/MediumResolution/> (Data)

Diadromous Fish Distribution - USFWS - <http://www.fws.gov/GOMCP/identify.html>

Dams (Impoundments) - Me Office of GIS - <http://www.maine.gov/megis/catalog/>

# Historic Diadromous Fish Distribution



# Number of Species Lost

