Marine Resources

Beth Howe and Ernie Burgess

Relative to most other towns in the State, one of the most unusual characteristics of the Town of Chebeague Island is that most of its area is sea rather than land. The town covers 12,701 acres, 10,482 of which are water. The land area of the Town is spread out between 14 islands and parts of two others. Some are rock outcrops or are less than an acre in size. The largest island, Great Chebeague itself, is only 1,926 acres.

Fishing has always been a major part of Chebeague's economy. Traditionally it had a diverse along-shore fishery with fishing for different species at different times of year. Now the fishing is limited primarily to lobstering and clamming. Lobstering, in particular is Chebeague's most important export industry. There is still a small amount of groundfishing and scalloping.

Table 1: Occupation of household head, Average for 1850, 60, 70, and 80 Censuses

	Fishermen	Mariners	Farmers	"Other" 1880 only
Chebeague	19.1%	50 %	24.8	16%
Long	76.4%	5%	9.1%	14%
Peaks	45%	16%	12.1%	40%

The sea has a great deal of economic value for Chebeague in addition to providing employment and income from fishing. In the latter half of the 19th century, 20 percent of households were headed by fishermen and 50 percent by mariners, engaged in activities such as stone slooping. Since the late 19th century, Chebeague has also been a destination for summer vacationers who enjoy fishing, swimming and boating.

The Bay is by far our largest area of open space. Just as houses built next to large parks have higher property values, we all take for granted that houses on or within sight of the shore have higher values than those that have no water views. The decade by decade mapping of the development of Chebeague shows dramatically the increases of houses on and near the water, The 2005 *Chebeague Housing Study* found that in 2004 the median sale price of houses on the water was $1,220,250 compared with $279,000 in the interior of the island.

Beyond its economic value, the Bay has nurtured and shaped Chebeague's way of life since before the first white settlers. Its beauty and complexity is a wonder to us.

Marine Ecology/Oceanography of Gulf of Maine

Casco Bay is a large estuary within the Gulf of Maine (Map 1). The surface waters in the Gulf of

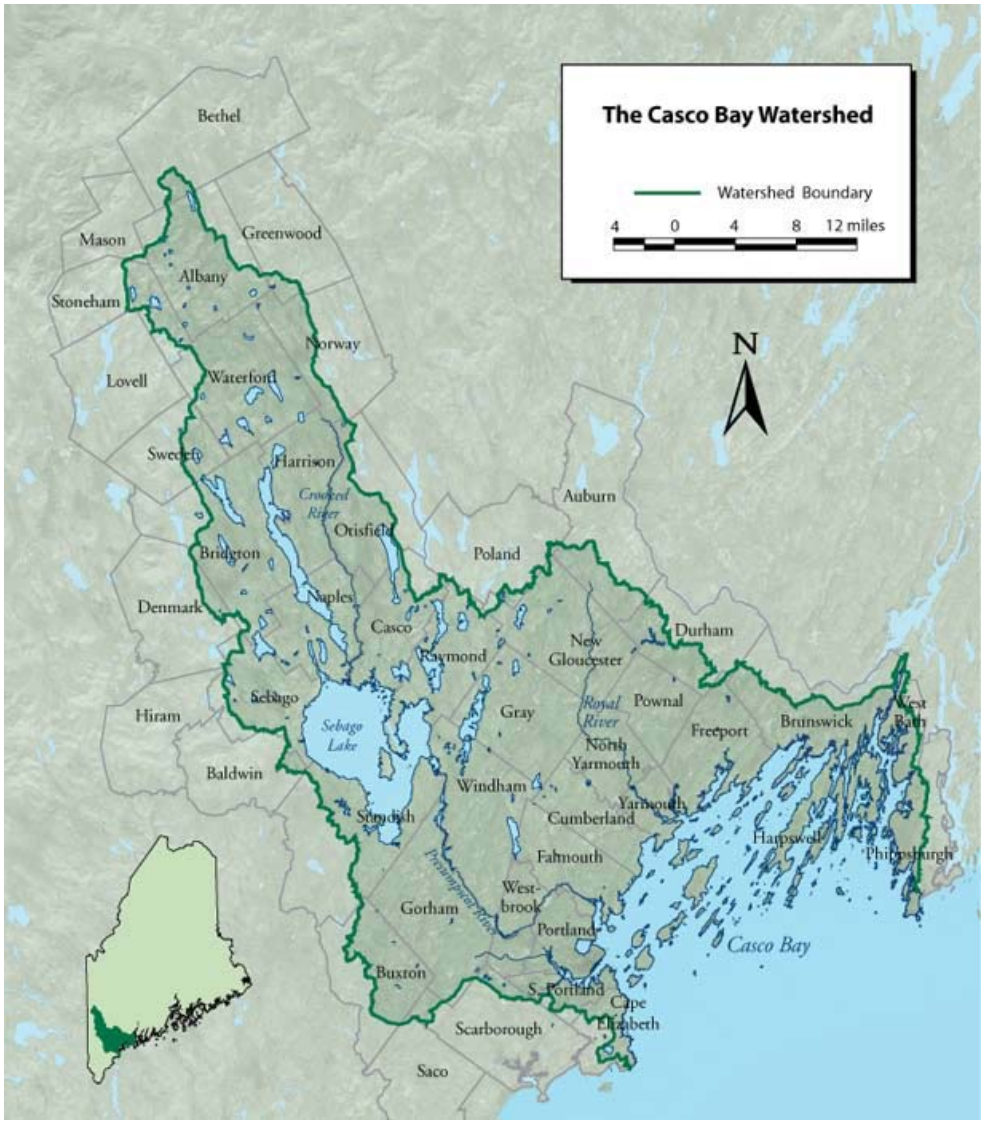
Map 1: The Gulf of Maine

Maine flow in great counterclockwise gyre generated by the Nova Scotia Current – a cold offshoot of Labrador Current from the Atlantic in through Northeast Channel. The gyre is also propelled by water from the spring thaw in rivers and by tidal action. It takes three months for water to go through one revolution of this gyre. In addition, the cold Labrador water keeps the waters of the GOM cooler than those in the Atlantic and results in cooler air temperatures for Maine and Nova Scotia in summer, and warmer ones in winter.

An estuary is an area where large amounts of fresh water from rivers run into the sea. As Map 2 shows, the rivers for Casco Bay are the Fore, Presumpscott, the Royal, Cousin, Harraseeket and New Meadows Rivers. An estuary includes a variety of distinct zones. The inshore areas of an estuary have the least penetration of strong waves and tides and are have salt marshes created by rivers. At the seaward edge of an estuary, on the other hand, the waves and tides are strong, and sand, leaving bare ledge. In between is a zone of mixed energy where tides and storm waves can be significant, but some areas are sheltered from the ocean's direct energy. As an off-shore Island in the middle of Casco Bay, Chebeague is in this mixed energy area, with its south shore facing the outer islands and open ocean and its more sheltered north shore facing the mainland.

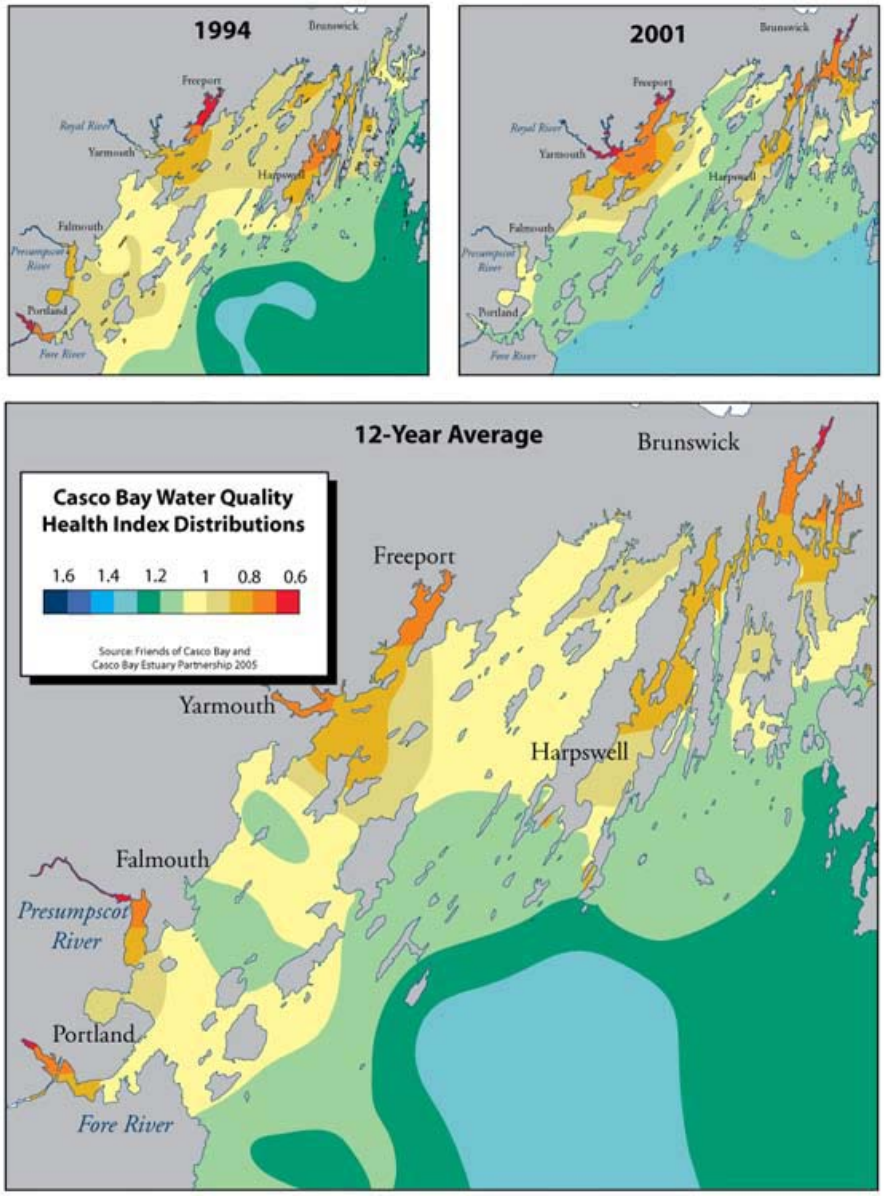
Unlike much of the open Atlantic, the Gulf of Maine is a very productive "garden" rich in microscopic, single-celled phytoplankton. These phytoplankton are eaten by zooplankton – fish larvae, worms, larval lobsters, mollusks, and other tiny animals, which, in turn, are eaten by larger fish and shellfish which in turn are eaten by people.

The productivity of the Gulf depends on sunlight, carbon dioxide, oxygen, tides, fresh water from the land, nutrients like nitrogen and phosphorous and temperature variations from surface to bottom and across the seasons. The Bay works like a big biological machine to produce life in many forms. The key is Casco Bay's favorable conditions for the photosynthesis of plants.



Map 2: Casco Bay Watersheds

The Bay's cold waters hold more dissolved oxygen and carbon dioxide than warm water – encouraging plant life. If water is still, it tends to settle into stable stratified layers with less dense, less oxygenated warm water on top and heavier, colder, more oxygenated water at the bottom. If stratification occurs, in summer the top water is warm and sunny but has few nutrients because they settle out to the bottom so there is little photosynthesis.



Map 3: Friends of Casco Bay Water Quality Health Index

But in many parts of Casco Bay, and at different times of year there is mixing of the layers:
from the strong tides, and

from cooler water sinking in the winter, called “convective overturn”.
This mixing brings nutrients like phosphorous and nitrogen up to the surface from deep water where they have settled. Also nutrients come continuously into the bay from rivers and runoff from the land.

In waters penetrated by the sun and rich with nutrients and carbon dioxide, the phytoplankton photosynthesize and, like other plants, bloom and give off oxygen. In summer the Bay’s become stratified and not highly productive. In winter the cooling surface water sinks, taking the phytoplankton down into deeper, darker waters. In winter the sun is simply not strong enough to produce photosynthesis. But in April/May and in September/October, the sunlight is strong enough and the water isn’t warm enough to become stratified yet so sunlight, carbon dioxide and nutrients are all brought together and photosynthesis occurs. The resulting water rich in dissolved oxygen, is a sign that photosynthesis is occurring. The oxygen itself supports marine life, and the phytoplankton support the zooplankton which, in turn, support larger animals.

Shoreline areas, including islands, are particularly productive areas of this good habitat.
In GOM large tides create more intertidal habitat for animals like clams and mussels.
Water near the shore where waves break is more oxygenated. And the shore itself creates areas where there can be up-wellings of nutrient-rich deeper water.

The down side of the high marine productivity of an area like Casco Bay is that it can be, in effect, too productive. Nutrients such as phosphorous and nitrogen are necessary for photosynthesis. However, if too many nutrients flow into the bay from such sources as sewage treatment plants, farm fields, fertilized lawns and street runoff, photosynthesis can run amok, producing large amounts of phytoplankton and green algae. When these plants die, they are attacked by bacteria that consume much or all of the dissolved oxygen in the water, possibly even killing all other forms of life. This is called “eutrophication”.

Water Quality
The water quality monitoring done by Friends of Casco Bay throughout the Bay from 1993 to the present, including on Chebeague, indicate that the water quality of the Bay is generally good, with the dissolved oxygen saturation in the water largely above the state standards of 70% for urban areas like Portland and 85% for less developed parts of the Bay, levels chosen because below them, biological processes start to be harmed. There is relatively little sign that there are enough nutrients flowing into the Bay to cause eutrophication.

But there is a lot of variation in water quality seasonally, over the years, and in different parts of the Bay. To capture this variation FCB developed a Casco Bay Health Index (Map 3) based on the dissolved oxygen saturation and the clarity of the water in readings taken between 1993 and 2004. The index has a range from .60 at the low (red) end to 1.35 at the high (purple) end. The average annual value for the whole Bay is about 100.

Low scores mean that the water contains less dissolved oxygen and has less clarity as a result of river sediments and pollutants. Low scores are found in Portland Harbor (.70 and .77) and in the area of the Presumpscot (.68), Royal (.71) Harraseeket (.79) and New Meadows Rivers (.70 and .77) which have more turbid water with sediments, point source pollutants from sewage

treatment plants and non-point source pollution from fertilizer and stormwater runoff. These are also enclosed and restricted areas where there is not much mixing with cleaner ocean waters.

High scores indicate water that is clear and high in dissolved oxygen. These scores are characteristic of offshore places like Halfway Rock (1.32), Rams Island Ledge (1.20) and Small Point (1.24).

As this suggests, there is a clear increase in the index as one moves from the rivers, inshore areas of the Bay, and restricted upper bays such as the New Meadows River to the offshore areas like Halfway Rock.

Chebeague has a score of 1.18 and a monitoring site in Broad Sound had a score of 1.17. These compare to the highest score of 1.32 at Halfway Rock and the lowest score of .68 at the Route 9 bridge on the Presumpscot River. On a more elaborate index for a smaller number of testing sites that included data on nutrients and florescence from photosynthesis, the site at Broad Sound was midway between the highest scores in the offshore areas and the lowest ones in Portland, on the Presumpscot River and in Middle and Quahog Bays.

Map 4: Twelve-Year Mean Summer Surface Dissolved Oxygen

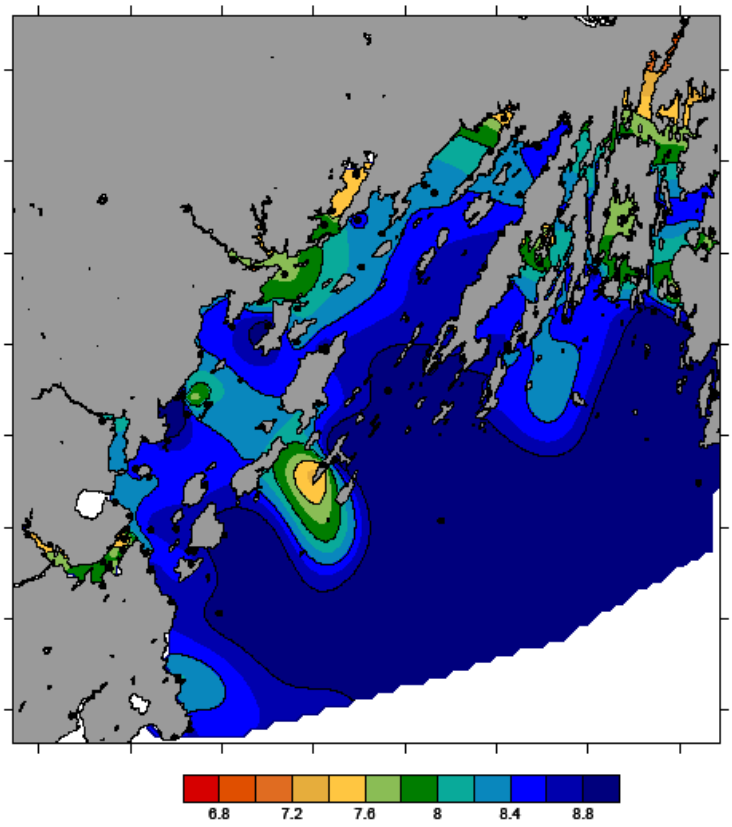


Figure 9. Spatial distribution of 12-year mean summer surface DO concentration (mg/l).

Green Algae at Indian Point

One problem that is highlighted by these findings is the effect of overboard discharges on the Bay's water quality. In 1994 57,020 acres of Casco Bay were closed to clamming from Cape Elizabeth up into Harpswell Sound at least partly because of the numerous overboard discharges on the islands and in Harpswell. At that time Chebeague had two overboard discharges in Chandler's Cove, closing it. In addition the cove off the Stone Wharf was closed. By 2004, however, the closures affected only 19,174 acres.

In Harpswell, as an example, between 1999 and 2004, when the State was working to reduce overboard discharges, these areas of concern were significantly reduced. Similarly, Cliff Island, with shallow soils and a number of overboard discharges also has surprisingly low dissolved oxygen readings in the summer when those houses are being used (Map 4). Chebeague, however, with its deeper soils suitable for septic systems, now has only one overboard discharge left.

Despite the generally good water quality in the Bay and specifically in the Town of Chebeague Island's waters, in late summer Chebeague's most productive clam beds have areas covered with green algae. This algae kills the maine animals beneath it. This is a sign of nitrogen pollution from waste-water treatment plants and fertilizers. Some of this may reach Chebeague from the Royal River. Readings at Sea Meadows on Cousin's Island also indicate problems. But Chebeague is also putting fertilizer into these waters just off our shores.

Deleted: r

One other aspect of the Gulf of Maine oceanography is that the sea level is rising about 1 inch every 10

Deleted: years.

Marine Habitats and Their Residents

Chebeague has a wide range of marine habitats where different substrates and water depths are inhabited by different animals and plants. The two primary human uses of Chebeague's waters are fishing and recreation and these also vary by marine habitats as well.

The Intertidal

The life-forms in the intertidal have to be able to live in areas which are not covered by water for at least part of the tidal cycle. This is also an area which commonly has a lot of wave action. Some animals, such as barnacles can survive for longer periods out of water, while mussels, crabs and lobsters can only manage a short time. Intertidal areas also vary depending on the nature of the ground surface. Sandy and muddy areas shelter burrowing clams while mussels can attach themselves to boulders, cobble and rock outcrops with their byssal threads.

Mud and Sand Flats: Clams and Mussels

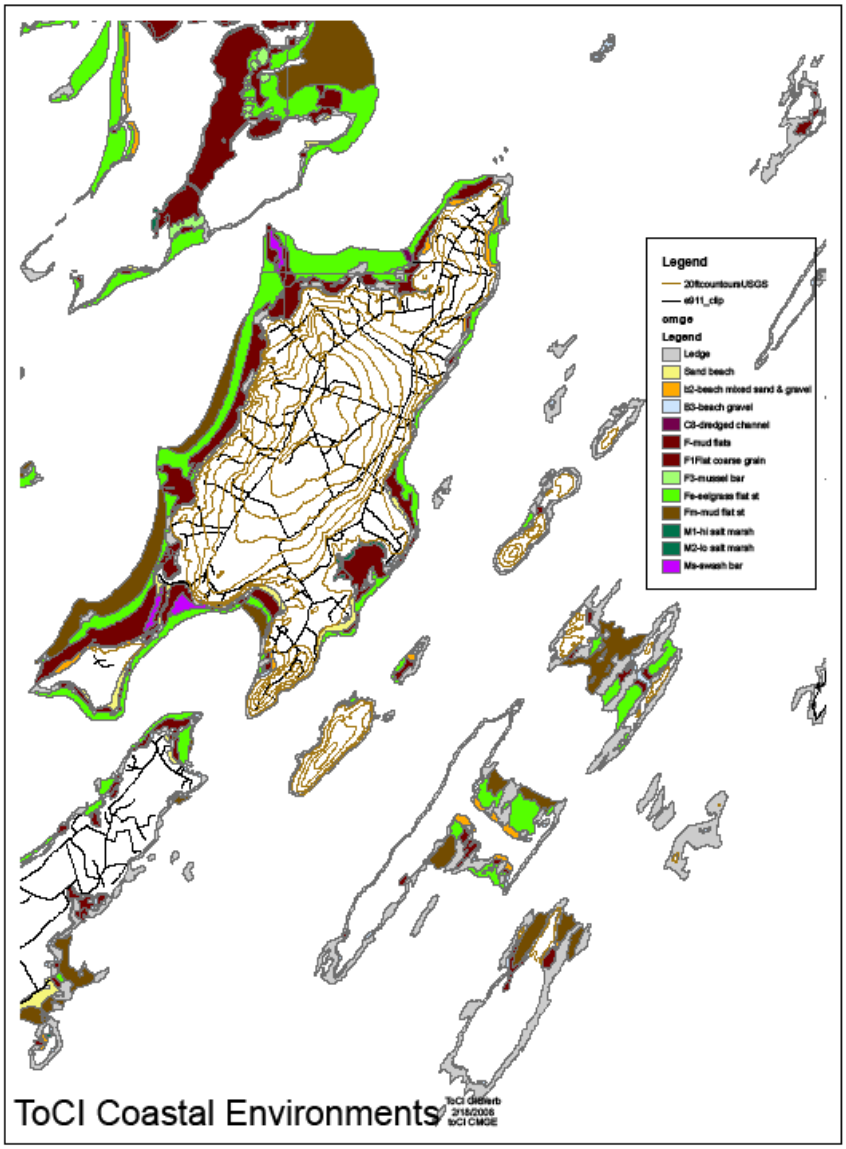
Chebeague has geology suitable for clam-flats, that is sand beaches and muddy tidal flats, around most of its shoreline. In the past, judging by the shell middens left by the Indians and the reports of 19th century clam-bakes, these were probably heavily populated with clams. Now, however, only Indian Point Cove/Little Chebeague Bar, Johnson Cove and a few smaller areas have densities of clams suitable for commercial harvesting. State DMR considers a clam flat productive if more than half the clams in a periodic sample are large enough to be harvested

legally (2 inches or larger). At the moment, Indian Point Cove is closed to harvesting to allow its clam population to recover to this level.

Clams have several significant predators. Eider ducks are fond of clams. Moon snails drill holes in their shells, sucking out the clam without breaking the shell. Green crabs which were introduced into Maine in the 1940s have been a major problem. The crabs break the soft shells

Deleted:

c Map 5: Coastal and Intertidal Environments



of any size of clam with their claws to get at the meat. They decimate the clams in the subtidal area, leaving only a fringe of clams along the low tide line.

People who eat clams are subject to diseases caused by water pollution that it taken in by the clams in their filter feeding. The State requires the Shellfish Warden to test the water in any area that will be open to commercial clamming. On Chebeague there are eight sites where water samples are collected between April and November. The samples are sent to the state and tested for salinity and coliform bacteria. If the tests show more than the State minimum for coliform bacteria, the clam flats in that area will be closed. Factors that can affect the water quality include boats with heads that flush into the Bay, overboard discharge from seasonal houses, outfalls from sewage treatment plants, the presence of many waterfowl or domestic or wild animals, and snow-melt, significant rain or floods. If a community does not test its waters, its clam flats are closed. This is the case with Long and Cliff Islands. Clam flats can also be closed by the State because if red tide which may be related to excess nitrogen in the water.

Rocky Intertidal: Mussels and Baby Lobsters
Mussels in the intertidal are only collected by individuals wanting a meal or sometimes for bait. Commercially, mussels were farmed on bottom leases by fishermen who collected baby mussels and released them at their lease area. Now they are largely grown on ropes suspended from rafts in the water column.

When post-larval baby lobsters settle to the bottom they mostly settle in water less than 60 feet deep in cobble or rocky areas, though they may also burrow in eelgrass beds. However, some do find hiding places under rocks in the lower intertidal zone, where their presence and characteristics can be monitored by The Lobster Conservancy to give some ideas of the density of settlement and future numbers of legal-size lobsters. Such baby lobster habitat has been found on Chebeague only in Bennett Cove, so far, which has a suitable rocky habitat.

In the intertidal area these baby lobsters are vulnerable not only to the usual natural lobster predators, but also to disturbance by people walking on or flipping their rocks. State law prohibits handling of pre-legal-size lobsters, but such a regulation is difficult to enforce except through education and voluntary compliance. Might there be some local protection?

Beaches and Rocky Shores: Human Beings
The intertidal zone is the only marine area that people can enter and explore without a boat or diving gear. Sandy beaches are the most popular habitat for people, both for vacation activities and for setting off fishing gear. Conflicts between recreators and animals on beaches are generally not a major issue. Horseshoe crabs which come up onto the beach to lay their eggs used to be taken. Now they are much less common, and are protected by law.

Mudflats and rocky shores are less frequented by vacationers unless they go to harvest shellfish or to explore tidepools.

Sub-tidal Bottom

Eelgrass and seaweed nursery habitats

Eelgrass beds (in bright green on Map 5) occur in shallow water where the grass is exposed to lots of sunlight. The many blades of grass provide good shelter against predation for small or juvenile animals including scallops, mussel seed, striped bass, winter flounder and lobsters. The eelgrass traps suspended sediments and so helps to clear the water and let the sunlight penetrate.

Eelgrass is sensitive to excessive nutrients and disease. It is now recovering from a long period of slime mold wasting disease, and runoff from residential and commercial development as well as residential and agricultural fertilizers can encourage phytoplankton blooms that keep sun from reaching the eelgrass. In addition mooring anchors can damage eelgrass by the movement of the mooring rope as the tide shifts. There are screw moorings with a floating rope that prevent this.

Deleted: .

Seaweed grows in shallow water where the water moves fast enough to keep soft sediments from settling. Seaweeds fasten to the rocky substrate with holdfasts. Rockweed, whose fronds may live for 20 years, and bladderwrack make shallow forests that protect crabs, lobsters and small fish. Seaweed also protects the shore from erosion. Finally, as it breaks up, it contributes to the marine vegetable soup that is eaten by filter feeders like clams and lobsters when they are molting and can't scavenge.

Sub tidal mud, sand, gravel/cobble, boulders and rock outcrops

Subtidal mud and sandy bottom provides little cover for animals that can't bury themselves or mimic the sand. Groundfish are either camouflaged or hide among sand ridges. Lobsters sometimes bury into the mud. Even so, Chebeague fishermen see the young of pollock, hake, pogies, bluefish, flounder, cod, smelts and herring.

Gravel, cobble and rocky bottoms provide much more cover for animals and places for plants and sessile animals like hydroids, tunicates and anemones to attach themselves to the rocks. Sea stars and urchins browse on the bottom. Lobsters, crabs and juvenile cod can shelter under and between rocks.

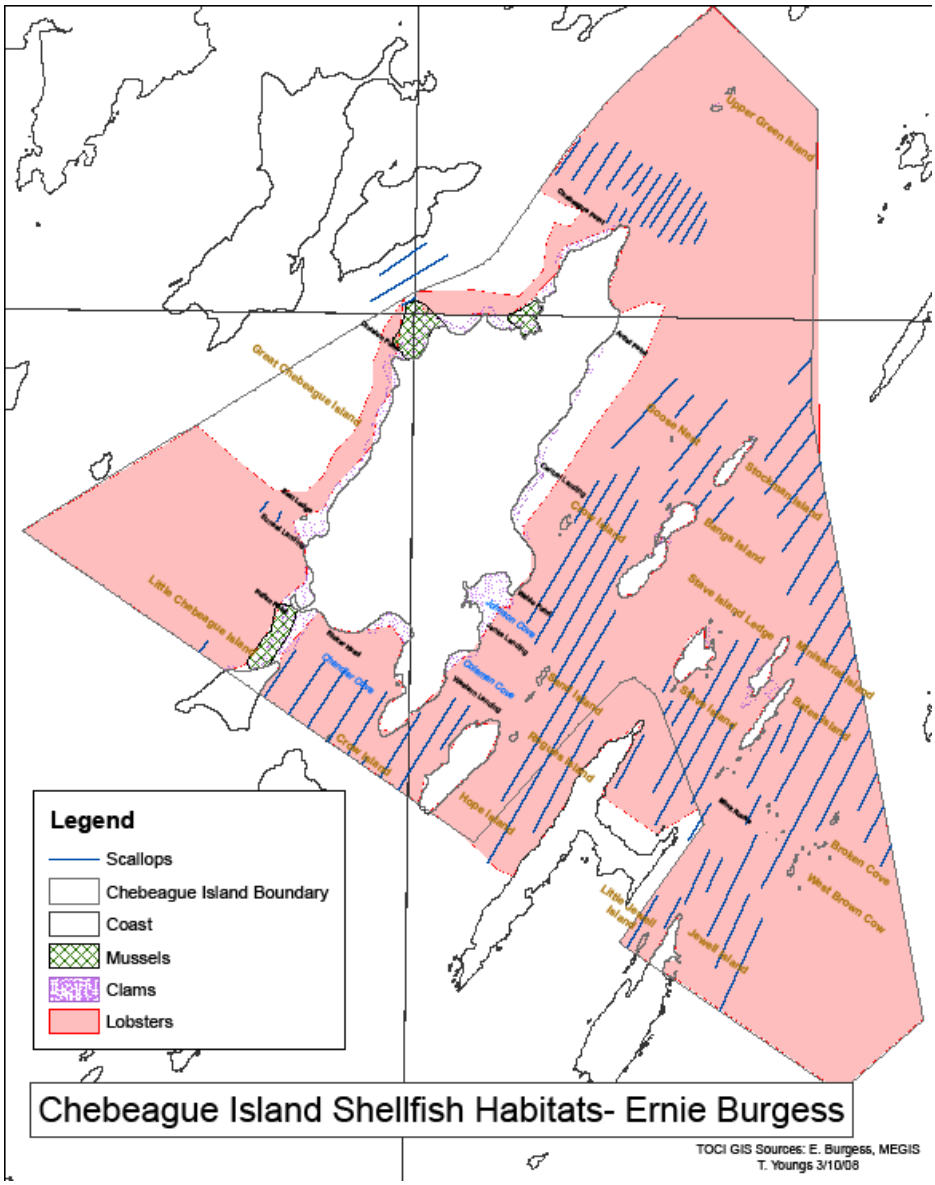
Lobsters

Almost all of the Town of Chebeague's waters are habitat for lobsters, though as the bottom varies from sand to cobble to ledge or boulders, the lobsters may find it more or less suitable.

Lobsters in Casco Bay appear to be abundant, though in recent years the catch has fluctuated. Statewide lobster landings in the state of Maine rose sharply in the 1990s and into the new millennium. Poundage landed increased from about 40 million pounds in 1995 to over 70 million pounds in 2005. It then fell back to closer to 60 million pounds in 2007. On Chebeague, poundage landed by Dropping Springs, LLC rose from 2004 to 2006, and then dropped off five percent in 2007, less than the state average decline.

Lobsters are largely caught in traps, though there has been some pressure to allow lobsters to be taken by dragging. Maine's lobstering regulations, going back many years, are designed to protect the resource. Females with eggs are v-notched and put back, and females without eggs

but with an old v-notch are as well. Small lobsters are returned to grow larger, and very large lobsters are returned as brood-stock.



Even with these regulations, the collapse of other fisheries such as groundfish and sea urchins, and the difficulty of understanding the complexities of the Gulf of Maine ecosystem makes people nervous about the future of a fishery that has such large catches every year. However, monitoring of juvenile lobsters in the Gulf of Maine suggests that catches in seven to ten years may be quite abundant.

DMR considers one lobster per square meter to be a high density. Densities of juvenile lobsters at Chebeague's Bennett Cove have risen steadily from .06 lobsters per square meter in 2000 to 1.1 in 2008, with a peak density in July 2008 of 1.9 lobsters per square meter, with a minimum carapace length of 10 cm and a maximum of 62cm. Chebeague is not unusual in this regard. This pattern of growth in the number of juvenile lobsters between 2000 and 2008 has been seen in all the other juvenile lobster sampling areas in Casco Bay, with peak densities at some sites approaching 5 lobsters per square meter.

This increase in hatching and settlement of juvenile lobsters may be related to the increasing temperature of Maine's waters. When the mean annual water temperature rises above 10 C (50 F) the number of baby lobsters settling and surviving through their first year increases significantly.

The presence of juvenile lobsters now hardly guarantees the presence of similar numbers of legal size lobsters in seven to ten years. Epizootic shell disease which produces lesions spreading from the carapace to the abdomen and claws, has spread from south of Cape Cod north to Maine over the past six years. However, it has not been found in Chebeague waters up to this point. This disease or some other widespread threat to lobsters could significantly affect the coming cohorts of baby lobsters.

Rock Crabs
Crabs are a bycatch from lobstering and are not common enough to create a significant fishery. Seals eat many crabs, reducing the supply.

Scallops
Scallops like sand, gravel and cobble bottom. They can occur on the bottom in many areas of Chebeague's waters. They are fished by dragging. Statewide, the pounds of scallops landed peaked in the early 1980s at over 3 million pounds. Since the early 1990s it declined consistently down to less than 22,000 pounds in 2004 and 2005.

Due to the overfishing the DMR proposed to reduce the number of fishing days in 2009 and limit the daily commercial catch. Six large areas along the Maine coast including Casco Bay were proposed to be closed to fishing for three years. In the end, there was a short season but the likelihood of significant restrictions remains. In the last legislature the drag ring size was increased from 3.5 inches to 4 inches. The Legislature also began to move toward limiting entry into scalloping. The Federal government has developed a Northern Gulf of Maine Scallop Management Area intended to create a more sustainable harvesting program.

Sea Urchins.

Chebeague had a few sea urchin harvesters during the short heyday of this short-lived fishery between 1993 and 1996. Urchins were taken for their roe, both by dragging and by divers. This fishery quickly reduced the numbers of urchins.

The Water Column

This is all the area in the ocean between the sea floor and the sea surface. The water may vary in temperature, density and salinity. Plankton such as copepods and larval stages of bottom-dwelling animals such as crabs and lobsters, live in the area near the surface that receives light, and fish feed on the plankton. This means that the water column is a critical, if high risk, nursery habitat for many marine animals. Below, in the dark realms of the sea, some animals live primarily on detritus from the waters above, while others move up at night to feed.

Some salmon, mackerel, menhaden, shad, dogfish and other sharks, bluefish, squid and some herring move in and out of the Gulf of Maine seasonally.

Cod, haddock, hake, ocean perch and flounders live in the GOM year-round. The bottom dwelling fish live on the nutrients and phytoplankton that sink to the bottom. Each species has its own particular areas including smaller spawning areas in the non-coastal areas of the Gulf of Maine or on the banks that define its outer edge. The numbers of groundfish have declined fairly steadily since the early 1940 as measured by domestic commercial landings. Upswings have been due to improvements in fishing technologies that have combined with adverse environmental conditions to reduce stock even further.

Mussel Farming

Mussels live naturally in the shallow water and the intertidal zone. In these areas they are eaten by birds and local people who collect them on a non-commercial basis. However, farmed mussels are suspended in the water column from mussel rafts. The Town of Chebeague Island has one commercial mussel farm owned by someone not from the island.

The Chebeague lobstermen appear to have a strong commitment to the idea that the bottom of the Bay is a collective resource and do not approve of state regulatory practices that grant leases to mussel farmers or any other kind of aquaculturists that deny lobstercatchers access to the bottom in those areas.

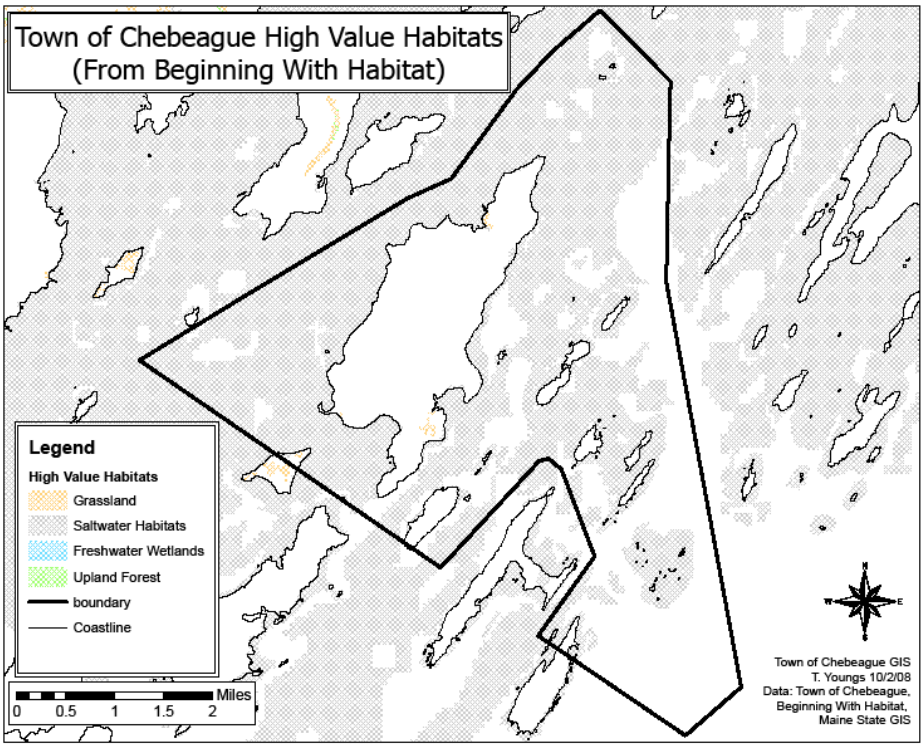
Language about mussel farms from 2000 plan

> The Chebeague fishermen are concerned about the impact of this new fishery on their access to places where they have set their traps in the past. The survey suggests that this is not a widely understood or recognized issue among Islanders who are not lobstermen.
>
> The waters around Chebeague have the potential to be excellent aquaculture sites for several reasons:
>
> - Strong tidal flushing,
> - Protection from wind, weather and seas,
> - Numerous areas of sand and mud for intertidal shellfish habitation,

- Warm water temperatures during the summer months.

Mussel grow-out rafts, which require deep water and strong tidal flushing could be practical at almost any protected cove or area near the Island, though this does depend on the season and weather conditions as well.

Most of Chebeague's waters are listed as highest value habitat for rare, threatened or endangered species or species with persistent declining population by the U.S. Fish and Wildlife Service. The fish included in this list that are found in Casco Bay are alewives, American eels, shad, Atlantic salmon, Atlantic sturgeon, blueback herring, bluefish, horseshoe crabs and winter flounder. These are not generally fish that are of economic importance to Chebeague's fishermen, but their habitats overlap entirely with species that are.



Map 6: High Value Marine Habitat

The water column is also plied by commercial and pleasure boats. Most pleasure boats as well as lobster boats and commercial barges generally operate in inshore waters. The same is true for

the ferries that serve the Casco Bay islands including Chebeague. These are important elements of the Town's economy in addition to fishing.

Moorings for boats and for rafts servicing the lobster and mussel industries also use space on the open water. Moorings can create use conflicts which will be examined in the next part on the marine economy.

Predators, invasive species and fishing damage

As has been discussed in a number of the sections above, many animals are predators of economically important invertebrates. Eider ducks eat mussels and clams as do shags. Seals eat lobsters and crabs unless they are tempted away to eat pogies and other fish. Seals are as marine mammals. Green crabs and moon snails eat clams. Asian shore crabs are newly introduced invasive species – not found yet on Chebeague, but found in Harpswell. Don't know what damage they do.

Deleted: legally protected

Fishing by dragging itself is harmful to the bottom as the drag turns up and breaks up whatever is on the bottom. Some bottom-dwelling animals seem to be able to escape and live to be caught in the future, but "improvements" in dragging technology make this less likely.

Any fishing that takes an animal that is spawning, as the urchin fishery did, creates problems for the long-term survival of the animals and the fishing. Lobster regulations take this fact into account. Fishing for shrimp in Maine captures many shrimp with eggs, but this may be mitigated by the rocky bottom in areas where there are shrimp. This means that parts of the area cannot be dragged so that many shrimp with eggs escape.

As this inventory indicates, overfishing is a major problem in reducing stocks of marine animals. Inefficient fishing may be better fishing.

Issues

Jurisdiction

The state owns and controls all the waters below the intertidal out to the three mile limit, so they regulate all the fisheries, requiring permits and bottom leases and setting harvesting regulations, seasons and quotas for various kinds of fish and shellfish. Even in the intertidal they regulate clamming through water testing and the requirement to dedicate clamming license revenues to clam flat maintenance.

The Federal government controls waters further out and plays a role in the management of many fisheries. Sometimes there are conflicts between Federal and State regulations, but often they are made to be compatible.

The issue for the Town may be how to increase the Town's role in this state-controlled system.

This is also a major area of the plan where regional approaches to issues are critical. Working with Friends of Casco Bay, the Casco Bay Estuary Project and other voluntary and governmental agencies is essential to deal with problems.

Pollution

Nitrogen pollution from Chebeague to clam flats – Identify sources of fertilizer. Monitor green algae

Pollution of other areas of the Bay – regional issue. Estuary Project, Friends of Casco Bay

Clams

Reduction in distribution, numbers and size of clams – manage flats; close flats to Recover. Is there any way to reduce predation by birds and green crabs?

Mussels

No definition of areas suitable for mussel farming.

Lobsters

Protect the r State regulations

Deleted: esource¶

Protect baby lobsters in intertidal?

Protect and encourage eelgrass beds – pollution and disease

tor water temperature change

Deleted: Moni

Scallops

Input into new regulations being developed by the State.

Invasive species

Asian shore crabs

Green crabs

Sea level rise

Deleted: ¶

References

Conkling, Philip (ed.). *From Cape Cod to the Bay of Fundy: An Environmental Atlas of the Gulf of Maine*. Cambridge MA: MIT Press, 1995).

Corson, Trevor. *The Secret Life of Lobsters*. New York: Harper Collins, 2004.

Cowan, Diane. *Report to Volunteers and Friends.* Friendship Long Island: The Lobster Concervancy, March 2008.

Friends of Casco Bay. *Twelve-Year Water Quality Data Analysis 1993-2004 Report.* Brunswick ME: Batelle Applied Coastal and Environmental Services, June 29, 2005.

Maine State Planning Office. *The Geology of Maine's Coastline*. Augusta ME: SPO, June 1983

Tyrell, M.C. *Marine Habitat Primer*. Gulf of Maine Council of the Marine Environment, 2005.