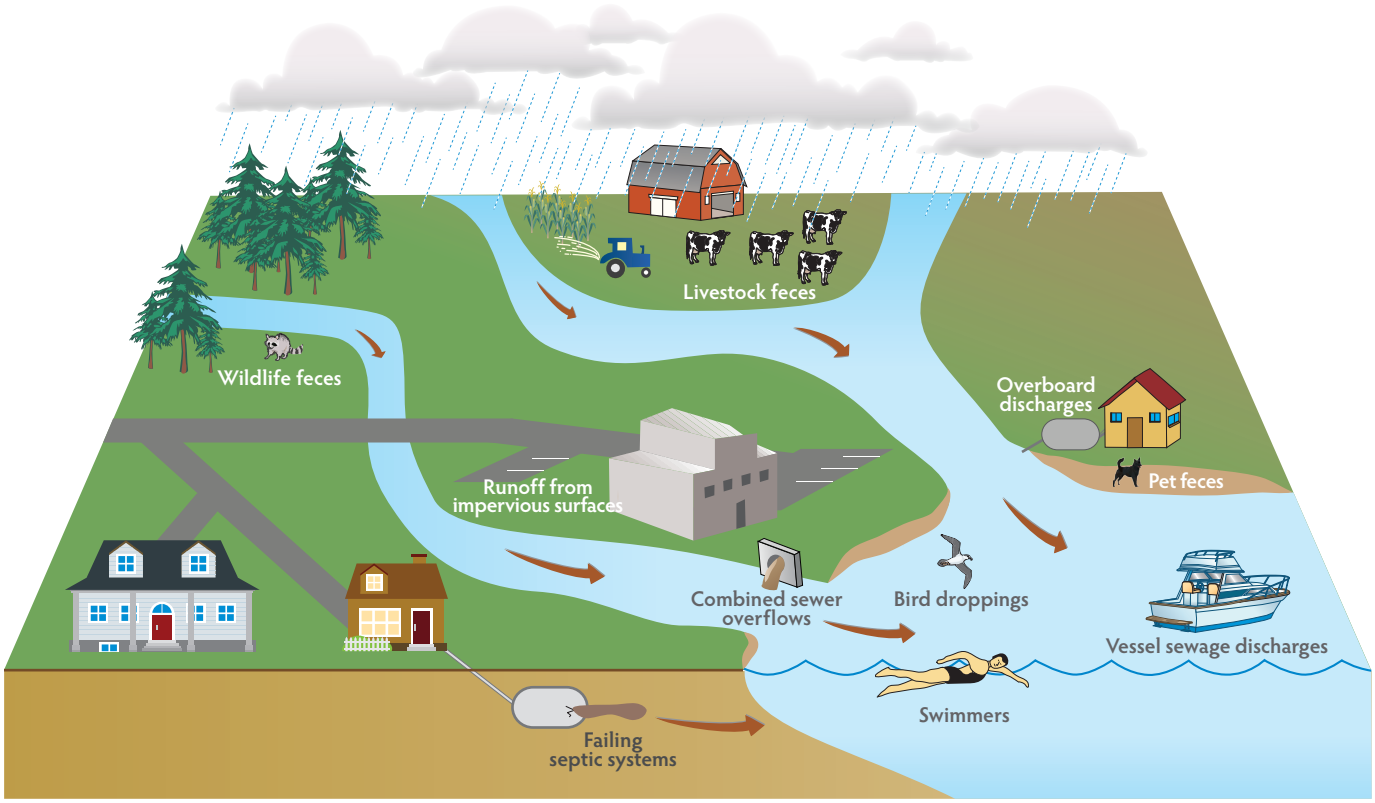
SECTION TWO

Pathogen Pollution



Disease-causing pathogens can enter Casco Bay coastal waters from multiple sources, leading to potential public health risks.
Illustration by Waterview Consulting including symbols adapted from the Integration and Application Network, University of Maryland Center for Environmental Science.

Introduction

Pathogens, which include disease-causing bacteria, viruses, and parasites, can be found in fecal material from humans and warm-blooded animals. They can enter coastal waters through sewage effluent, agricultural and stormwater runoff, or malfunctioning septic tanks. They also find their way into our waters via pets, wildlife, swimmers, and boaters.

Exposure to pathogens through ingestion of contaminated shellfish, or contact with polluted waters, can present a public health risk. Managing that risk requires monitoring for the presence of indicator organisms. The ideal indicator is one associated with fecal contamination, easy to measure, relatively harmless to humans, and found in greater numbers than pathogens. Under federal and state rules, fecal coliform bacteria are the indicator used to assess water quality in shellfish harvesting areas, while *Enterococci* bacteria are measured at beaches and swimming areas.

Monitoring provides resource managers with the information they need to decide when to protect public health by posting an advisory at public beaches, or closing shellfish beds to harvesting. CBEP's two pathogen pollution-related indicators (Indicators 5 and 6) are discussed on the following pages.

INDICATOR 5

What is the status of swimming beach monitoring in Casco Bay?

CBEP Goal: Open and protect swimming areas impacted by water quality.

Why Is Beach Monitoring Important?

Monitoring the water at recreational beaches regularly is necessary because the risk of exposure to pathogens changes with weather conditions and source inputs. For example, a rainstorm can wash pathogens from land and carry them into recreational waters, temporarily degrading the water quality, and increasing the risk of eye and ear infections, sore throats, and gastric illness. By monitoring for the indicator bacterium *Enterococcus* during the summer beach season, managers can identify periods when the risk of illness exceeds acceptable levels. Beach monitoring is a voluntary activity in Maine, and the decision to monitor or to issue swimming beach advisories or closures based on monitoring results is left to the discretion of local and municipal beach managers, or to state park officials.

Status of Casco Bay's Beach Monitoring Program

The Maine Healthy Beaches (MHB) Program is a US EPA-funded partnership started in 2003 to ensure that local beaches are safe and clean. Municipalities, the University of Maine Cooperative Extension/ Sea Grant, state agencies, and nonprofits participate in beach monitoring, data analysis and public outreach.

MHB Program signs notify swimmers of beach status using color coding. An orange overlay indicates swimming is not advised and red indicates the beach is closed to swimming.

MHB currently monitors 60 coastal beach management areas, including three beaches in Casco Bay considered high-priority due to volume of use and potential risk of contamination. (Many swimming spots around Casco Bay are not monitored.) Local beach managers take water samples and record weather conditions from Memorial Day to Labor Day three times a week at Portland's East End Beach, twice weekly at South Portland's Willard Beach and, since 2008, once a week at Winslow Park in Freeport, tides permitting. Using *Enterococcus* bacteria counts, the beach's history, bather numbers, and recent rainfall to assess health risks, the managers post beach status online. They also use color-coded signs and flags at the beaches themselves. (For more information, see www.mainehealthybeaches.org.)


Selfnoise

Trends

When seawater samples collected by the MHB Program contain 104 MPN (Most Probable Number) or more *Enterococci* per 100 milliliters of beach water, water quality is considered degraded. High levels of those indicator bacteria are often observed on Willard and East End beaches during and immediately following heavy rainfall, suggesting that stormwater runoff is a key contributor to beach water quality at those urban beaches.

Total Beach Action Days* per Year at Casco Bay Beaches

	Willard Beach, South Portland	East End Beach, Portland	Winslow Park, Freeport
2003	0	0	
2004	7	6	
2005	11	1	
2006	11	0	
2007	3	4	
2008	3	6	0
2009	23	24	0

The high number of advisories and closures in 2009 can be attributed to the 24.79 inches of rain reported in Portland during the beach season (approximately 2.5 times above average).
Source: Keri Lindberg, Maine Healthy Beaches, personal communication.

*The numbers are based on data provided by the Maine Healthy Beaches Program. An Action Day refers to the number of days a beach is posted with an advisory against swimming or a closure where 1 day ≤ 24hrs; 2 days > 24hrs but ≤ 48hrs; 3 days > 48hrs but ≤ 72hrs.

Casco Bay No Discharge Area and Pumpout Facilities

Sewage discharge from boats can be a significant source of pathogen pollution to coastal waters. With strong state and local support, the US EPA designated Casco Bay as Maine's first No Discharge Area (NDA) in 2006. In Casco Bay, discharge of both treated and untreated vessel sewage is prohibited in all waters between Two Lights in Cape Elizabeth and Small Point in Phippsburg, including the navigable reaches of the Fore, Presumpscot, Royal, Cousins, Haraseeket and New Meadows Rivers. Maine has also enacted legislation that controls the discharges of combined sewage and gray water (sink and shower water) from large commercial passenger vessels. That legislation is unique to Maine and, in combination with the NDA, results in coastal waters that receive the highest regulatory protection from vessel discharges in the United States (Maine DEP 2010).

Federal NDA designation under the Clean Water Act requires that boaters have access to an adequate number of pumpout facilities. In Casco Bay there are 21 commercial shoreside facilities, and one mobile pumpout, the Friends of Casco Bay Vessel Pumpout Boat. That mobile pump-out service offers boaters a convenient, legal way to empty their vessel's holding tanks, by pumping out the tanks at docks or moorings. FOCB's Pumpout staff also helps boat owners locate and operate shoreside facilities. Since 1995, the services of the pumpout boat have prevented more than 100,000 gallons of raw sewage from entering Casco Bay's waters. (For more information, see http://friendsofcascobay.org/pumpoutprogram.aspx)

FOCB

Solutions and Actions

The MHB Program is working with communities statewide on public education campaigns, special monitoring and circulation studies, mapping and "hot spot" analysis, and sanitary shoreline surveys to identify pollution sources.

For example, a 2006 sanitary shoreline survey at Willard Beach in South Portland identified five storm drain outfalls discharging directly into the water. Those outfalls could be moved into deeper water to reduce their near-shore impacts (Mosley 2006). Littering (which attracts gulls), poor sanitary practices by bathers, and failure to remove dog waste also increase pathogen loading to the beach. Continuing public education is helping to address those human impacts. In addition, discharge of wastes from boats anchored at a mooring field offshore of Willard Beach has been illegal since the 2006 Casco Bay No Discharge designation (see sidebar). The Maine Healthy Beaches' boater education program has further reduced illicit and accidental discharges.

The *Maine Statewide Bacterial Total Maximum Daily Load* (TMDL) report, completed in 2009, should also help to reduce pathogen inputs. The TMDL sets targets for allowable levels of bacteria in state waters. The maximum levels provide pollutant targets under the federal Clean Water Act, constraining permitting, funding and other actions. The report provides documentation and maps of impaired areas, and information on pollutant sources. It also offers tools to help communities and other stakeholders implement bacterial control strategies. One of the case studies in the report is a shoreline survey training program for municipal employees in Casco Bay communities, which CBEP helped to sponsor in partnership with the Maine Department of Marine Resources and the Maine Department of Environmental Protection.

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Maine Department of Environmental Protection. 2010. *No Discharge Areas* (http://maine.gov/dep/blwq/topic/vessel/nda)

Mosley, Sarah. 2006. *Willard Beach Sanitary Shoreline Survey.* Maine Healthy Beaches Program.

INDICATOR 6

Has the acreage of open shellfish beds in Casco Bay changed over time?

CBEP Goal: Open and protect shellfish areas impacted by water quality.

Why Is Open Shellfish Bed Acreage Important?

For many residents and commercial diggers around Casco Bay, shellfish harvesting is both an important tradition and livelihood. Soft-shell clams (*Mya arenaria*), blue mussels (*Mytilus edulis*), quahogs (*Mercenaria mercenaria*), and other species provide significant economic benefits to the region. Some sheltered coves also present optimal conditions for shellfish aquaculture. In most parts of the Bay, determination of whether mudflats and other shellfish areas are open to harvest depends on the degree and extent of fecal pollution, which is assessed by monitoring representative fecal coliform bacteria levels. Tracking changes to shellfish management area classifications leads to knowledge of the levels of fecal bacteria in the Bay, which adds to an understanding about the Bay's current water quality.

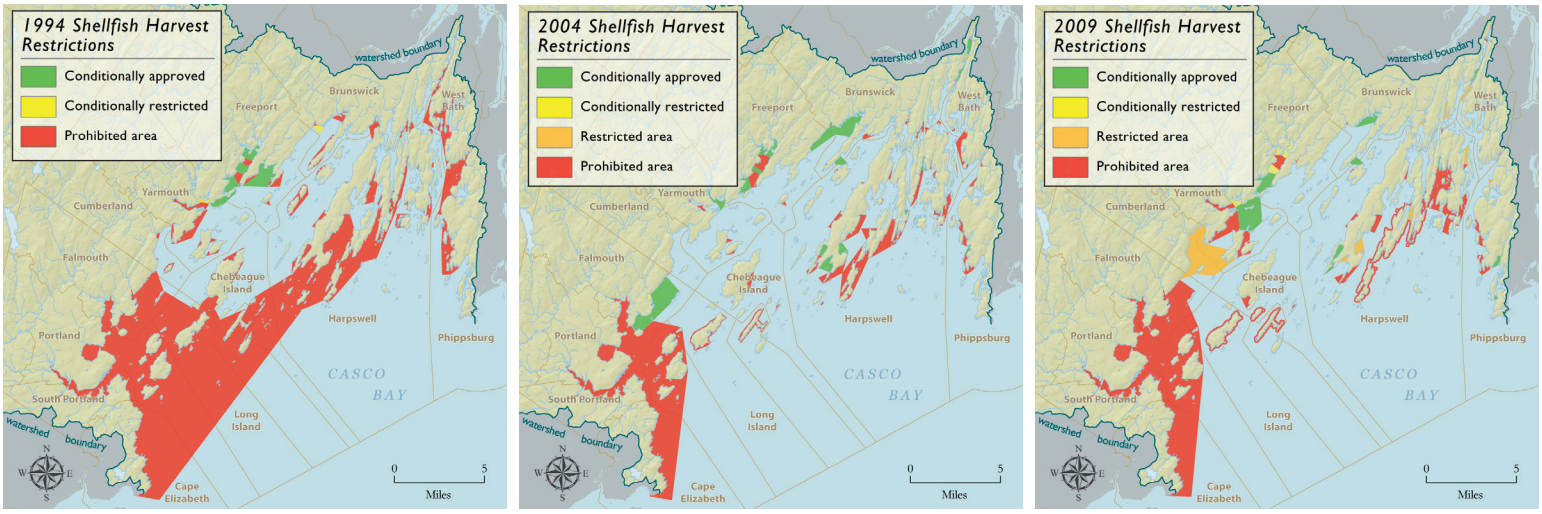
Mike Timberlake

Status and Trends

The National Shellfish Sanitation Program (NSSP), directed by the U.S. Food and Drug Administration and administered locally by the Public Health Division of the Maine Department of Marine Resources (DMR), determines the water quality standards that shellfish areas must meet to ensure that shellfish product falls within public health thresholds for human consumption. Under the NSSP, DMR classifies shellfish areas as prohibited, restricted, conditionally restricted, conditionally approved, or approved based on an assessment of the risks of illness. Each management area's status is determined by several criterion such as proximity to private or municipal wastewater treatment facilities; recent heavy rains (which can wash pathogens and other pollutants into the Bay); the presence of high levels of fecal bacteria; dangerous red tide levels; toxic substances in sediments; or a combination of the above. In Casco Bay, most shellfish bed closures occur due to the presence of anthropogenic sources of fecal bacteria carried in stormwater runoff, and fecal bacteria associated with human waste from malfunctioning septic systems, release of treated and untreated sewage from boats, combined sewer overflows, and overboard discharges.

Brad Lauster

Local, state, and federal agencies have taken important steps to reduce fecal pollution inputs to Casco Bay by removing overboard discharges, eliminating combined sewer overflows, and designating Casco Bay as a No Discharge Zone. Nonetheless, fecal bacteria counts persist at elevated levels in many areas, resulting in widespread restrictions on harvesting shellfish. In 2009, shellfish harvesting remained prohibited throughout much of southern Casco Bay, including but not limited to, the Fore River/Portland Harbor, Back Cove, the Presumpscot Estuary, Peaks Island, Great Diamond Island, Mussel Cove, and the Royal River estuary. Much of Broad Cove, along with most of the

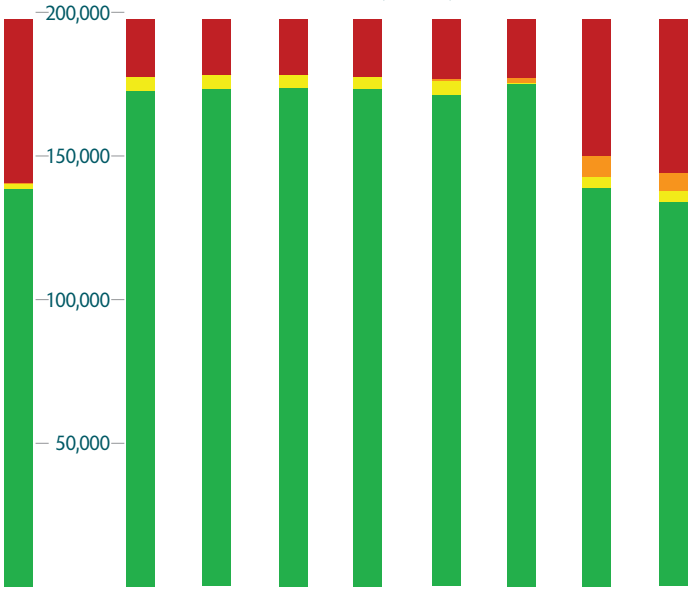


Shellfish Management Area classification status in 1994, 2004, and 2009. The 1994 and 2004 data were presented in the 2005 *State of the Bay* report. Although the maps show a dramatic reduction in prohibited area from 1994 to 2004, much of the change is attributed to closure lines being re-drawn to fit the shoreline of affected islands. Note: DMR did not use 'restricted' as a classification until 2000–2002. Data: Maine DMR

waters around Cousins Island, was classified as either restricted or prohibited in 2009. In eastern Casco Bay, Quahog Bay and Ridley Cove were classified as prohibited, along with sections of Sebasco Harbor and Small Point Harbor. Notable classification improvements between 2004 and 2009 occurred in the upper and lower New Meadows, and in sections of Maquoit Bay.

From 2007 to 2008, a shift in the proportion of open to closed shellfishing areas took place. The total area classified as prohibited more than doubled from 20,441 acres to 47,421 acres, while the total area classified as approved or conditionally approved area fell from 174,761 acres to 138,575 acres. Between 2004 and 2009, the total area classified as restricted increased sharply from 57 acres to 6,416 acres. Those shifts represent administrative changes in NSSP guidance, as well as in actual water quality changes. The increase in prohibited area can be attributed to a number of factors including: expanded closures around sewage treatment plant outfalls to ensure adequate dilution of effluent; the expiration of required sanitary surveys along the shoreline; and prioritization of commercial digging sites. The increase in restricted area reflects changes to NSSP standards. Areas that are affected by nonpoint source pollution, and which do not meet approved standards, are now classified as restricted, reflecting the fact that nonpoint source pollution is having a bigger impact on shellfish areas than in past years. Although the increase can be partially attributed to high rainfalls in 2008 and 2009, intensive development of coastlines and subwatersheds is a contributing factor.

Change in Casco Bay Shellfish Management Area Status 1994–2009 (Acres)



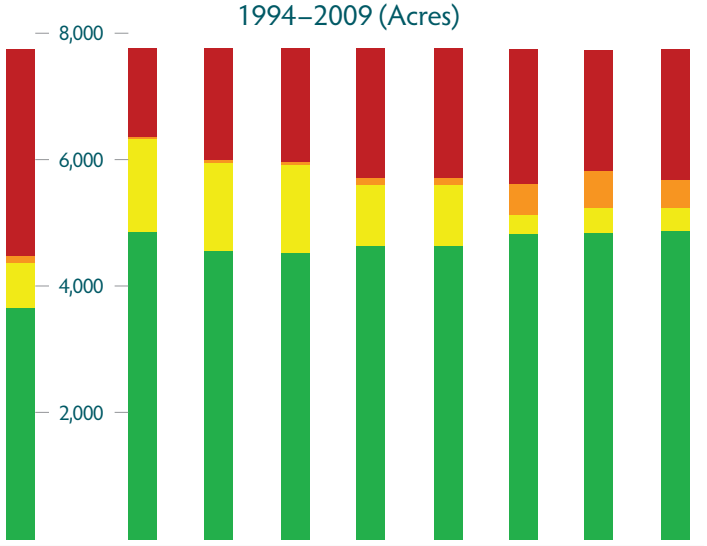
Status of Shellfish Flats	1994	2002	2003	2004	2005	2006	2007	2008	2009
Prohibited	57,020	20,014	19,260	19,174	19,908	20,845	20,441	47,421	53,356
Restricted	224	57	57	57	170	489	1,619	7,272	6,416
Conditionally Restricted	1,865	4,893	4,796	4,732	4,236	5,202	538	4,091	3,668
Approved or Conditionally Approved	138,250	172,395	173,245	173,395	173,045	170,823	174,761	138,575	133,919

Data: Maine DMR

Shellfish management areas are much larger than actual harvestable digging sites. Although tracking changes in the classification of entire management areas is a useful way to illustrate the extent of fecal pollution in Casco Bay, the scale does not accurately convey the specific impact that

classification changes have on where harvesters can dig for shellfish. To understand how classification has affected Casco Bay's most important shellfish industry, it is useful to review classification changes as they pertain specifically to mapped softshell clam digging areas. At that scale, classification trends are less pronounced. Although clam flats classified as prohibited increased from 1,774 acres in 2004 to 2,040 acres in 2009, an increase of 15 percent, there was a simultaneous increase in combined open (approved) and conditionally approved acreage from 4,504 acres in 2004 to 4,843 acres in 2009, a 7.5 percent increase. The area of clam flats classified as restricted increased from 49 acres in 2004 to 442 acres in 2009. Again, the impact of increased nonpoint source pollution on shellfish harvesting is evident. Consequently, nonpoint source pollution adjacent to shellfish harvesting areas is a topic of growing concern among state and local shellfish managers.

Change in Casco Bay Softshell Clam Bed Status 1994–2009 (Acres)



Status of Softshell Clam Beds	1994	2002	2003	2004	2005	2006	2007	2008	2009
Prohibited	3,233	1,376	1,749	1,774	2,033	2,301	2,107	1,897	2,040
Restricted	105	49	49	49	103	218	480	581	442
Conditionally Restricted	704	1,450	1,368	1,382	965	1,005	298	392	364
Approved or Conditionally Approved	3,644	4,832	4,542	4,504	4,607	4,186	4,805	4,819	4,843

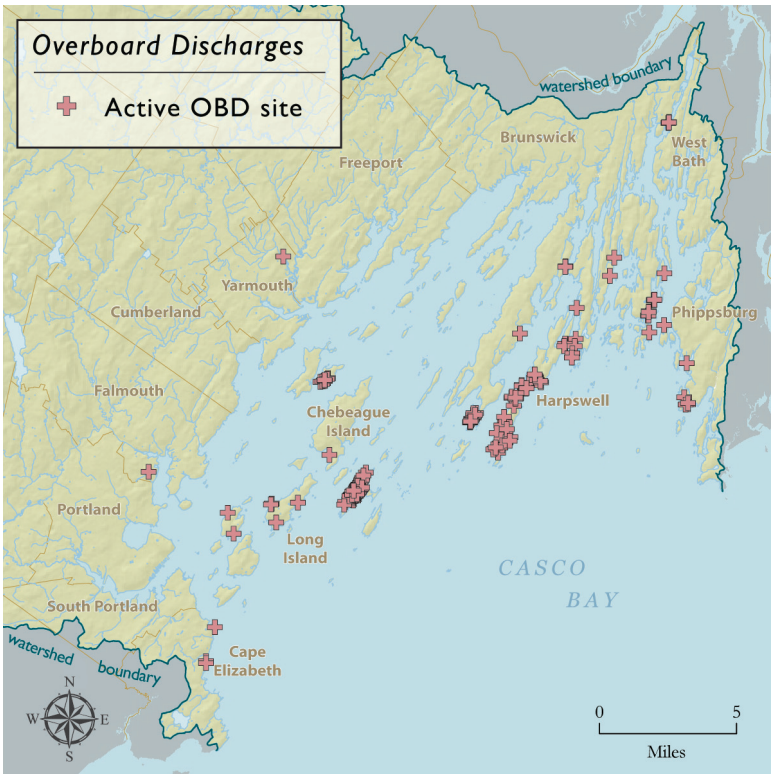
Data: Maine DMR

Solution and Actions

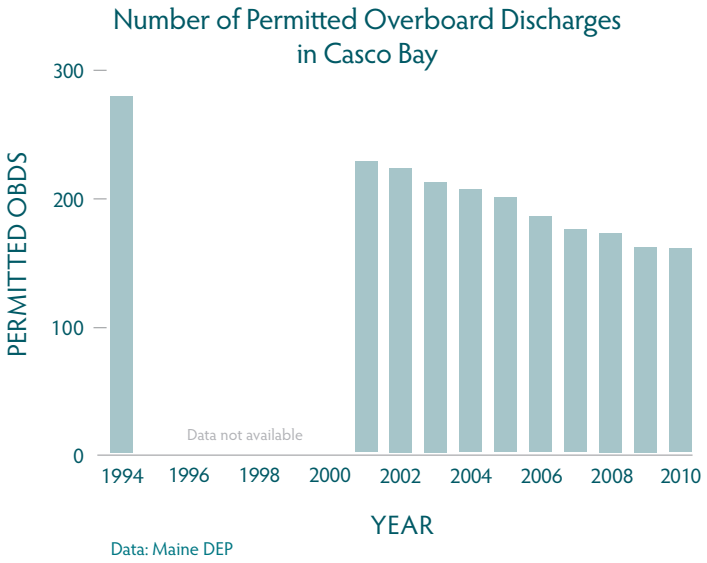
Overboard Discharge System Elimination

Between 1974 and 1987, Maine DEP regulations allowed treated, chlorinated overboard discharge systems (OBDs) to be built as a replacement for "straight pipes" or as an alternative to conventional inground septic systems. By 1987, nearly 400 OBDs had been installed in towns surrounding Casco Bay. Coastal buildings without access to publicly owned treatment facilities, or the ability to install septic systems due to poor soil conditions or small lot sizes, often had no other choice, because underlying ledge leaves little room for proper function and operation of leach fields. Since OBDs require consistent maintenance, they are considered by state and federal regulators to be a source of fecal bacteria, leading to mandatory prohibition of shellfish harvesting in adjacent areas. OBDs constitute a major cause of Casco Bay's shellfish management area closures.

To address that ongoing cause of shellfish closures, towns are working closely with DEP and DMR and continue to seek ways to remove and replace OBDs, particularly those located near productive shellfish resource areas. As a result, the number of permitted OBDs has declined by about half since 1995. Since 2004, despite a shortage of low-interest state loans to assist with removal and replacement costs, the



Data: Maine DEP



Data: Maine DEP

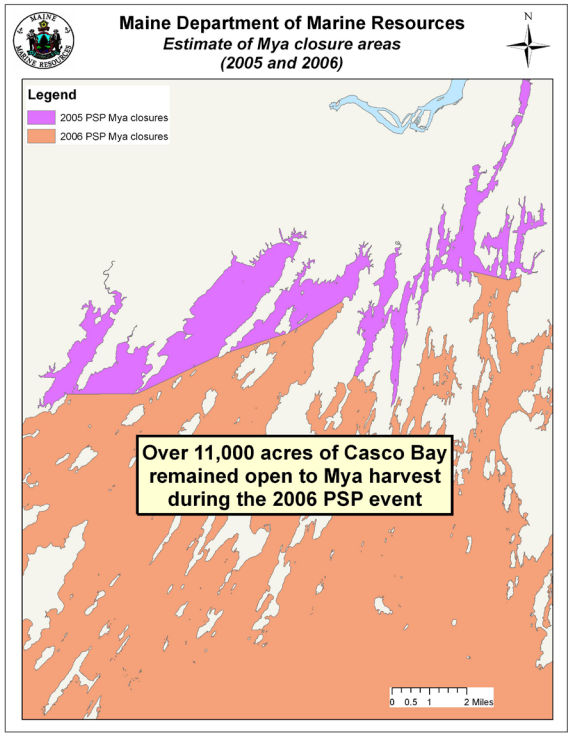
Peter Taylor

Harvesting clams in Harpswell.

Town of Harpswell has been successful in securing and utilizing Community Development Block Grant funds to replace OBDs by making a strong case for the economic development benefits of opening shellfish areas that have long been closed to harvest. Between 2001 and 2009, Harpswell eliminated 37 OBDs along its 150 mile coastline.

Red Tide

Harmful algal blooms of *Alexandrium fundyense*, also known as red tide, produce a biotoxin that accumulates in clams and other shellfish, and can lead to paralytic shellfish poisoning (PSP) if consumed. PSP-related closings have had a severe impact on Casco Bay's shellfish harvest since 2005, when an intense and prolonged red tide closed shellfish areas to harvest for weeks at a time, producing record levels of toxicity, and resulting in a disaster declaration for affected areas.



Since red tide was expected to continue for several years following the 2005 event, the Casco Bay Clam Team worked closely with Maine DMR to better understand red tide, and to enable finer-scale management of shellfish areas during red tide events. The 2006 pilot program created 43 new sampling stations which – along with the three DMR already had in place – provided comprehensive information about the extent and severity of red tide in Casco Bay. The additional data enabled continuation of shellfish harvesting in some near-shore flats, despite ongoing red tide blooms off shore. As a result of the pilot program, more than 11,000 acres of shellfish management area that had been ordered closed in 2005 remained open during the entire red tide event in 2006. Based on the success of the pilot program, DMR has maintained the new monitoring protocol in Casco Bay, and applied the approach to other areas of the state. (For additional information about red tide, see Section 3: Water Quality.)

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