

How is Casco Bay Doing?

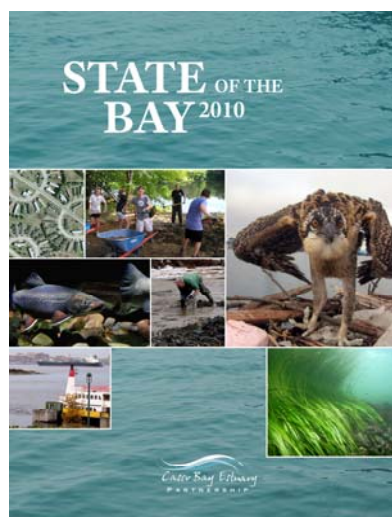
The *State of the Bay* report presents an assessment of the overall health of Casco Bay and its watershed. Produced every five years by the Casco Bay Estuary Partnership, the report aims to assemble available information on the condition of Casco Bay and make it readily available to the watershed's community at large. The report is also intended to provide insight to guide future efforts to benefit Casco Bay, its watershed, and the region's human and natural communities.

Findings of the 2010 Report

The 2010 *State of the Bay* report finds that, overall, Casco Bay is largely healthy. The Bay supports a remarkable abundance of fish, birds, and wildlife. Its watershed remains predominantly forested, and many of its streams are home to native fish and invertebrates. Over the past generation, concentrations of many toxic compounds in the Bay's surface sediments have declined, and less human waste now enters the Bay from combined sewer overflows and overboard discharges.

But there are problems on the horizon. The region's population continues to grow, and that growth has been concentrated in peripheral communities. Such a dispersed development pattern changes the character of rural communities, strains municipal and state budgets, and risks degrading water quality, wildlife habitat, and aesthetic quality. Other looming threats include continued bacterial pollution of beaches and shellfish beds from nonpoint sources, nutrient over-enrichment in parts of the Bay, increased numbers of invasive species in marine and fresh waters, and the uncertain effects of climate change and contaminants of emerging concern.

The 2010 *State of the Bay* report discusses both good news and less positive trends. It also highlights successes of the Casco Bay Estuary Partnership and its partners who work every day on behalf of Casco Bay.



The *State of the Bay* report presents a comprehensive picture of the health of Casco Bay and its watershed. The report is available at www.cascobayestuary.com

Measuring the Health of Casco Bay

It is no easy task to assess the overall condition of Casco Bay and its watershed, as information is always limited and there are many different ways to define "health." The *State of the Bay Report* represents the most complete analysis that the Casco Bay Estuary Partnership could assemble. It is based on 18 environmental indicators:

<p>Population, Land Use, and Watershed Impacts</p> <p>Indicator 1: Population Indicator 2: Impervious Surface Indicator 3: Stormwater Indicator 4: Combined Sewer Overflows</p>	<p>Habitats</p> <p>Indicator 12: Interior Forest Habitat Indicator 13: Conserved Lands</p>
<p>Pathogen Pollution</p> <p>Indicator 5: Swimming Beaches Indicator 6: Shellfish Beds</p>	<p>Living Resources</p> <p>Indicator 14: Eelgrass Indicator 15: Waterbirds Indicator 16: Invasive Species</p>
<p>Water Quality</p> <p>Indicator 7: Bay Water Quality Indicator 8: Inland and Estuarine Water Quality</p>	<p>Climate Change</p> <p>Indicator 17: Climate Change, Sea Level Rise & Ocean Acidification</p>
<p>Toxic Pollution</p> <p>Indicator 9: Mussels Indicator 10: Sediments Indicator 11: Contaminants of Emerging Concern</p>	<p>Stewardship</p> <p>Indicator 18: Stewardship and Community Engagement</p>

This factsheet presents findings for five of the above indicators. All 18 indicators are discussed in depth in the full report, which is available at www.cascobayestuary.org.

Bay Water Quality

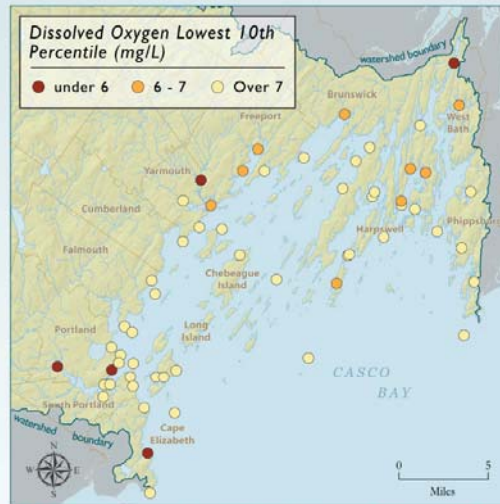
The overall water quality of Casco Bay is good, although there are a few sites where indicators have been measured at levels of concern.

Low dissolved oxygen at nearshore locations and especially near urban areas suggests that the Bay is experiencing localized pollution problems.

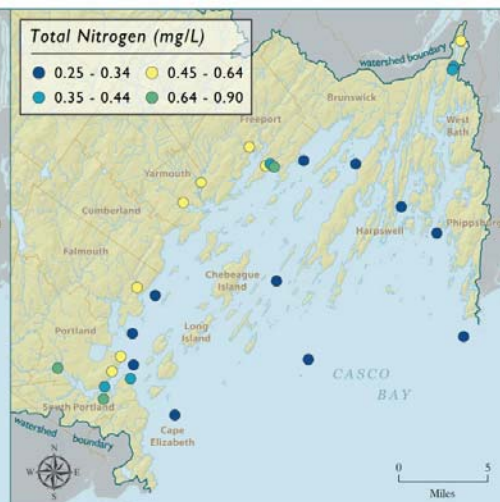
The distribution of all of the DO data – including more than 7,600 measurements – shows that 90 percent of the DO values in Casco Bay were above 7.2 mg/l. Only 0.5 percent fell below 5.0 mg/l. On the whole, those values are typical of well oxygenated, healthy coastal waters. Low dissolved oxygen levels that may be of significant management concern are still rare in Casco Bay.



If temperatures, sunlight levels and nutrient levels are high enough, green slime proliferates, especially in more protected areas such as mudflats, around piers and docks, and in sheltered harbors.

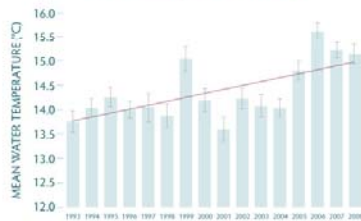


The lowest 10th percentile values for DO show where issues with dissolved oxygen may be occurring. There is a strong inshore to offshore trend of improving DO conditions. Sites that exhibit more frequent low levels of DO include Stroudwater Creek and Custom House Wharf in Portland Harbor, the Cousins River and the upper New Meadows River. The Peabbles Cove site in Cape Elizabeth occasionally experiences low levels of DO, probably as a result of decomposing storm-cast seaweed (FOCB 2010).



A clear decreasing trend from inshore to offshore can be seen for both parameters. This pattern of more nitrogen in areas with lower salinity, most likely from runoff, suggests that there is a significant contribution of nitrogen to Casco Bay from terrestrial sources (FOCB 2010).

Increase in Water Temperature in Casco Bay Since 1993



The annual mean water temperature has increased since 1993, with four of the five warmest years occurring in the last four years analyzed (2005 – 2008). Statistical analysis suggests that this is a meaningful trend, not simply a result of year to year fluctuations. Early morning data (collected prior to 10:00 AM) shows a similar statistically significant trend (FOCB 2010).

Water Quality Conditions in Casco Bay by Region



Regions are sorted the same way in all panels (in order of average DO levels, from highest to lowest) so comparisons can be made among parameters. For each region, 90 percent of observations had DO above the orange line. The error bars show +/- one standard deviation among measurements taken in a region to show the magnitude of local, seasonal and annual variability (FOCB 2010).

This is one of the eighteen environmental indicators addressed in the 2010 State of the Bay report. The full report is available at www.cascobayestuary.org.

Interior Forest Habitat

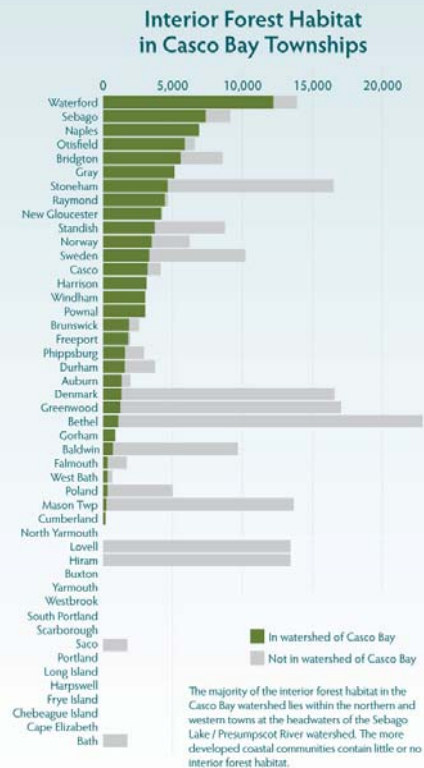


Forests provide essential habitat to many of Maine's native birds, fish, and mammals. Certain species, including large herbivores and predators such as fishers, hawks and owls, roam over large areas of forest and thus cannot survive in the small forests found in suburban areas. Many species of migrant songbirds, including many warblers, are forest specialists, nesting successfully only in large blocks of forest.

While to most humans there may appear to be little difference between the edge and the interior of a forest, there can be profound differences from the perspective of the animals and plants that live there.

Even in a largely forested watershed such as Casco Bay, suitable habitat for forest specialists may be uncommon. Their ideal habitat occurs only in large areas of forest that are compact in shape and are located far from most human activity.

- Almost 69 percent (676.0 square miles) of the 986 square mile Casco Bay watershed is forested (Maine Office of GIS 2004).
- In contrast, only 172.6 square miles (17.5 percent) of the watershed consists of interior forest habitat, the majority of which is located in the upper portions of the watershed.
- Interior forest is far less abundant in the more highly developed coastal communities, where suburban lands, abundant roads, powerlines, and other linear infrastructure cut the forest into smaller areas that provide little true interior forest habitat.



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Protected Lands



Examples of properties protected with support from the CBEP Habitat Protection Fund in Scarborough, Bridgton, and Pettingill Island (clockwise from top left).

- The Casco Bay watershed continues to provide valuable habitat for a range of fish and wildlife species. Available habitat, however, can be lost or degraded by human activity, especially urban and suburban development.
- 854 parcels in the lower 16 municipalities of the Casco Bay watershed, amounting to more than 25,000 acres and 12 percent of the area of the watershed, are being tracked in a geographic database of conserved and open space lands as of 2010.
- Some 15,694 acres—about 7.5 percent of the area of the towns examined—is considered permanently protected.
- The amount of permanently protected land in the lower 16 municipalities of the Casco Bay watershed has more than doubled since 1997.

Protected Lands in the Lower 16 Casco Bay Watershed Towns, 2010

Level of Protection	Number of Parcels	Total Acres Protected	Percent of Casco Bay Watershed
Conservation Land	438	15,694	7.5%
Open Space (no protection)	306	7,494	3.6%
Recreational Land	110	1,917	0.9%
TOTAL	854	25,105	12.0%

Increase in Permanently Protected Lands in the Lower 16 Casco Bay Watershed Towns from 1997 to 2010

Year	Number of Sites	Area Permanently Protected (acres)	Percent of Study Area
1997	246	7,300	3.5%
2005	341	10,900	5.2%
2010	438	15,694	7.5%

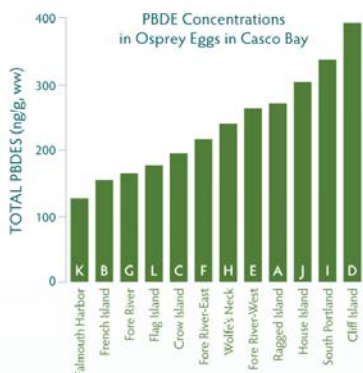
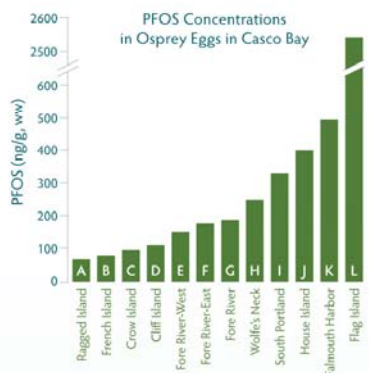


Contaminants of Emerging Concern

Many common synthetic chemicals, which were not recognized as pollutants in the past, are now being detected in aquatic ecosystems throughout the world, where they are accumulating in the tissues of wildlife and humans. Those "contaminants of emerging concern" persist in the environment along with the more traditionally monitored persistent pollutants like polychlorinated biphenyls (PCBs), organochlorine pesticides (OCs) and heavy metals.

Among the new class of contaminants are polybrominated diphenyl ethers (PBDEs), used as flame retardants in commercial and residential textiles, furniture foam, and electronics. Another important class of emerging contaminants is perfluorinated chemicals (PFCs), industrial chemicals whose common uses include stain repellents, Teflon coatings, cleaning agents, and fire-fighting foam. Two forms, perfluorooctanesulfonate (PFOS) and perfluorooctanoate (PFOA) are most common in the environment and in organisms.

PFOS and PBDE in Osprey Eggs

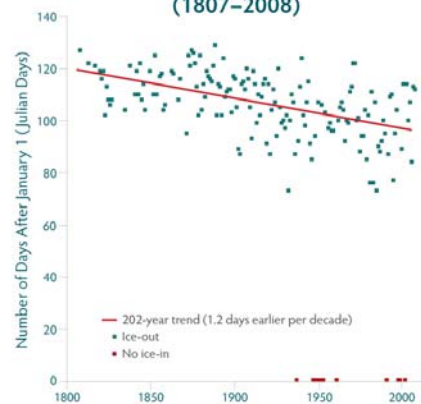


- PCBs, PBDEs, PFCs and OCs were found in all of the osprey eggs sampled in 2007 and 2009.
- Deca-PBDE was detected in 10 of 12 osprey eggs collected in Casco Bay.
- PFOS in an egg from Flag Island were the highest ever seen in Maine wildlife, and among the highest ever observed in a bird egg.
- Fully 75 percent of osprey eggs had PFOS concentrations exceeding the threshold for negative health effects established for chickens (100 ng/g, wet weight).
- No spatial trend was detectable among the samples, suggesting that point sources, watershed characteristics and food web dynamics may all play a role in exposure to contaminants (Goodale 2010).

Climate Change

- The Casco Bay region is warmer and wetter than it was a century ago.
- Both drought and flooding are likely to be more common than in the past.
- Sea level is projected to rise between two and five feet at Portland by the end of this century.
- Changes are likely in the chemistry of our coastal waters, including acidification that affects shellfish and other species.

Day of Ice-Out at Sebago Lake (1807-2008)



The day of ice-out is defined as the number of days past January 1st until the lake is considered ice-free. Average ice-out dates are about three weeks earlier now than they were in the mid-1800s. While ice-out dates in May were fairly common before 1800, they have occurred only three times since 1900. The day of ice-out has become an average of 1.2 days earlier each decade since the early 1800s. Red squares indicate years in which the lake did not freeze over (Wake et al. 2009).

Estimates of Future Sea Level Rise at Portland Harbor

Emissions Scenario	Lower		Higher	
	2050	2100	2050	2100
1998 stillwater elevation (ft)	8.9	8.9	8.9	8.9
Subsidence of coastline	0.024	0.043	0.024	0.043
Changes in ocean circulation	NE	0.52	NE	0.79
Global average sea level	0.66	1.6	1.4	4.6
Total stillwater elevation (ft)	9.5	11.1	10.3	14.3

Above are estimates of future changes in tidal elevation at the Portland tide gauge under lower and higher greenhouse gas emissions scenarios. Changes in elevation will reflect (1) subsidence of the Maine coastline; (2) dynamic changes due to changes in ocean currents; and (3) eustatic (global) changes in sea level due principally to changes in the volume of ocean water (Wake et al. 2009).

Protecting & restoring the ecological integrity of the Casco Bay watershed



The Casco Bay Estuary Partnership works to preserve the ecological integrity of Casco Bay and to ensure compatible human uses of the Bay's resources, through public stewardship and effective management.