

# State of the Bay 2009

Cape Cod Bay Monitoring Program



[www.coastalstudies.org](http://www.coastalstudies.org)

## Introduction

On behalf of the Provincetown Center for Coastal Studies (PCCS), I am pleased to present the State of the Bay 2009. This report presents a comprehensive analysis of water quality data collected during 2006, 2007 and 2008, as well as information on eelgrass ecosystems and the presence of invasive species in Cape Cod Bay. These data define the baseline condition of the Bay, which is critical to understanding current threats caused by human interaction and possible future impacts from our rapidly changing communities.

For over 30 years, PCCS has conducted research in Cape Cod Bay and studied this dynamic ecosystem, which covers over 604 square statute miles with its surface water. Designated as a State Ocean Sanctuary in 1970, the Bay sustains populations of fish, shellfish, and eelgrass and serves as an important habitat to a diverse array of wildlife including seabirds, pinnipeds and whales that frolic and feed in its waters. Designated as a critical habitat for the world's most endangered whale, the North Atlantic right whale, Cape Cod Bay offers an abundance of its favorite meal, zooplankton.

Water quality monitoring is a critical component of effective stewardship, education, and management of Cape Cod Bay. The Cape Cod Bay Monitoring Program provides an overall view of the health of the Bay. Data presented in this report establish a baseline for comparing future data and identifying trends over time. The Monitoring Program contributes to our ability to identify current and potential water quality issues and sources of pollution. Understanding natural and human-induced changes to the Bay helps us all to become better stewards of our waters.

Each of us has our own relationship with Cape Cod Bay, whether we walk the shoreline, or navigate its waters, fish, collect shells, bird watch, sail, kayak, row, or water-ski. No matter what we enjoy doing in and around the Bay, its health and productivity are essential for us all. We must act to preserve this marine ecosystem, and in doing so, sustain its quality for future generations, human and animal.

Richard Delaney, Executive Director  
Provincetown Center for Coastal Studies

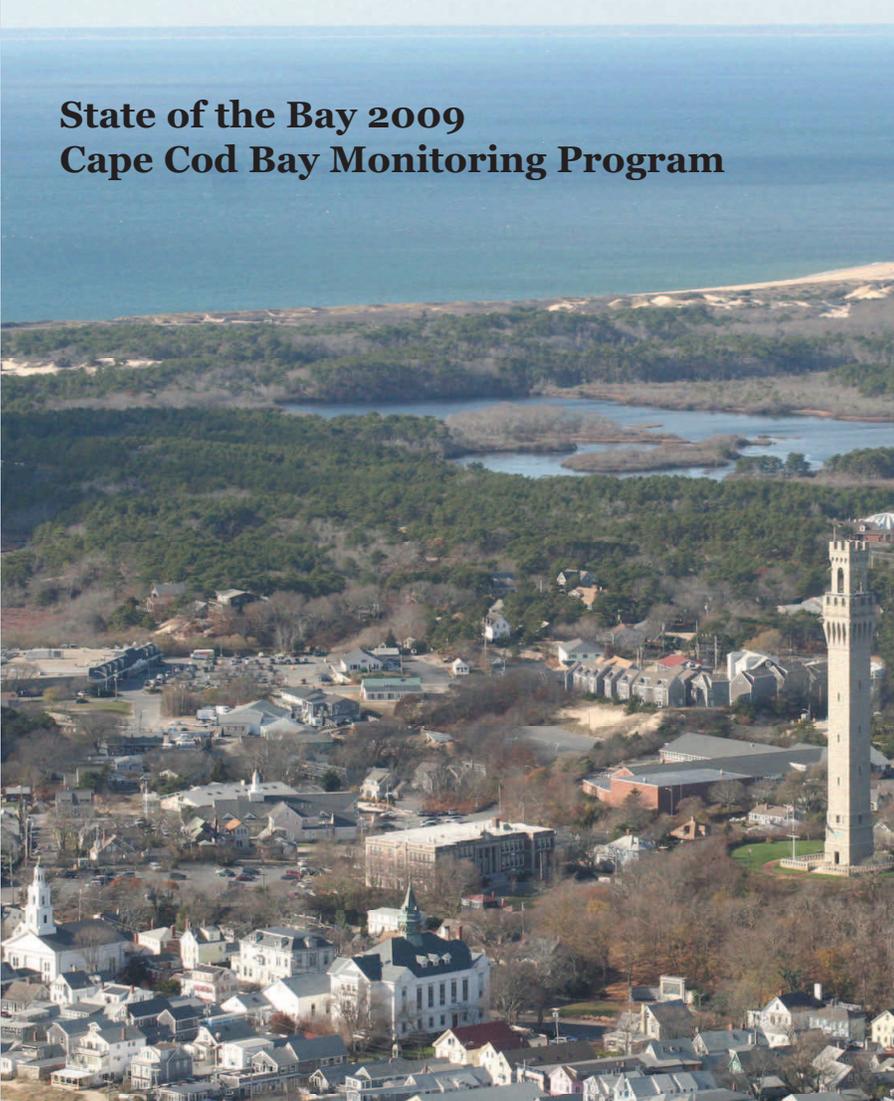


"State of the Bay 2009" is a publication of the Provincetown Center for Coastal Studies

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Cover image: PCCS, 2009

An aerial photograph of Cape Cod Bay, showing the coastline, a large body of water, and a town with a prominent lighthouse tower. The text "State of the Bay 2009" and "Cape Cod Bay Monitoring Program" is overlaid on the top left of the image.

## State of the Bay 2009 Cape Cod Bay Monitoring Program

## 2006-2008 Cape Cod Bay Monitoring Program

### Summary of Findings:

- There has been a significant increase in nitrate ( $\text{NO}_3$ ) levels in the offshore surface waters of the Bay;
- Each year during the summer months there is a degradation of water quality in the nearshore stations, with a decline in dissolved oxygen levels, an increase in nitrogen and phosphorous concentrations and a decline in water clarity;
- Water quality conditions at the inshore stations are more impaired than those measured in the nearshore and offshore stations, exhibiting lower levels of dissolved oxygen, higher levels of all forms of nutrients and higher turbidity. Generally the further inshore the station, the poorer the water quality.



## Overview

For over three decades, the Provincetown Center for Coastal Studies (PCCS) has been monitoring Cape Cod Bay. Much of our early research focused on whales. Since then our work has expanded to include biological, physical, chemical, and geological studies of Cape Cod and its surrounding waters. In the spring of 2006, PCCS implemented its newest water quality monitoring program, the Cape Cod Bay Monitoring Program. The foundation for this program was work done by PCCS from 2000-2004 to assess the impacts on Cape Cod Bay of the wastewater discharge from the Massachusetts Water Resources Authority's (MWRA) Effluent Outfall Tunnel, which discharges about 360 million gallons of treated sewage daily, 9.5 miles offshore from Boston Harbor.

Cape Cod Bay is a dynamic system. Water circulation in the Bay generally moves in a counterclockwise direction, with waters flowing in from Massachusetts Bay, along the south shore and easterly to Provincetown. Some water circulates within the Bay and some flows out past Race Point.

Although the earlier monitoring program found no statistically significant adverse effects to the Bay from the MWRA outfall, PCCS acted on recommendations to continue to research the potential long-term impacts of regional pollution on the marine environment. This and the additional goal to understand the impact from local pollution gave rise to the Cape Cod Bay Monitoring Program.

For three years we have collected data from over 50 stations located throughout Cape Cod Bay. Eight of these stations are located offshore, 31 stations are along the shoreline focusing on harbors and inlets (nearshore), and 14 stations are further inland and sampled from the shore by volunteers (volunteer/inshore). Data collected from the inshore and nearshore stations give us an idea of the degree of degradation resulting from local pollution from sources such as failing septic systems and run-off. Data from the stations located offshore will help us continue to track any changes resulting from regional pollution.

Most intensive sampling is done from May through October, with year round sampling conducted at select offshore stations. Data collected include in situ measurements of temperature salinity, dissolved oxygen, and pH. Additionally, water samples are collected for analyses at our state-certified lab. These analyses measure concentrations of nitrate/nitrite, ortho-phosphate, total nitrogen, total phosphorus, chlorophyll a, and turbidity.

Over the course of these three years we have spent 140 days at sea and collected nearly 3000 samples. Additional sampling has been conducted by volunteers at inshore stations. Ten to 15 volunteers visited their assigned sites weekly to record environmental data and collect water samples. These volunteers collected an additional 630 water samples.

## Water Quality Trends

We are now beginning to identify trends and document changes, based on the first three years of data. In this report the data for offshore stations, nearshore stations, and volunteer/inshore stations (Figure 1) are presented separately.

