State of the Bay 2007

Cape Cod Bay Ocean Sanctuary Program
Cape Cod Bay Monitoring Program
Table of Contents

Welcome ........................................... 1

Introduction ....................................... 2
PCCS on Cape Cod Bay .......................... 4

Part I • Monitoring Cape Cod Bay
Water Quality .................................. 5
Citizen Scientists ................................. 5
Eelgrass .......................................... 5
Monitoring Program Donors .................... 10

Part II • A Chorus of Conservation
Heritage & Culture ............................... 11
A Walk Along Cape Cod Bay .................. 12
Areas of Critical Environmental Concern .... 14
Habitat Restoration at Cape Cod National Seashore .... 14
Stormwater Runoff and Bacterial Pollution ....... 17
Vehicle Traffic Sources of Nitrogen for Coastal Lagoons .... 20
Boston Harbor Outfall ........................... 20
Cape Cod Bay No Discharge Area ............. 21
Coastal Zone Management on Cape Cod ......... 21
Cape Cod Bay Lobster Fishery (MA DMF) ........ 22
Cape Cod Bay Fisheries (MA DMF) ............. 23
United States Coast Guard ..................... 24
The Cape Cod Canal ............................ 24
NOAA Fisheries .................................. 25
Massachusetts Environmental Police .......... 25
Jones River Landing Environmental Heritage Center .... 26
The Canal Power Plant .......................... 26
Marine Resources ................................ 27

Part III • Resource Management
The Role of the Cape’s Towns ................. 30-34
Members, Cape Cod Bay Council .............. 34

State of the Bay Report
October 2007

Cape Cod Bay Ocean Sanctuary Program
Cape Cod Bay Monitoring Program
The Cape Cod Bay Ocean Sanctuary Program and the Cape Cod Bay Monitoring Program are initiatives of former PCCS Executive Director Peter R. Borrelli, who retired in June 2007. He strongly believes that we are responsible for the safe keeping of our natural world.

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Cape Cod Bay stretches from Race Point in Provincetown to Brant Rock in Marshfield

Satellite image, courtesy of NASA

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Welcome

Richard Delaney
Executive Director,
Provincetown Center for Coastal Studies

My long time bond with the wonders of Cape Cod Bay began with childhood summer vacation days on the beach, evolved into a career focused on coastal and ocean issues, and continues today, as the new Executive Director of the Provincetown Center for Coastal Studies. During that relatively short period, the surrounding coastal lands and towns that are so closely linked to Cape Cod Bay have experienced dramatic changes bringing new challenges to this famous ecosystem.

The Bay can be “viewed” and appreciated from many different perspectives. This State of the Bay 2007 Report offers several first hand reports from scientists, historians, educators, natural resource managers and others who use and enjoy these waters together conveying its extensive and exciting dimensions.

Clearly, the most important feature of Cape Cod Bay, and for the quality of life along the coast, is that it be preserved as an environmentally healthy ecosystem with unpolluted water, lush eelgrass beds, productive salt marshes, healthy populations of marine mammals and fish, and clean sandy beaches. This has been the mission of the Provincetown Center for Coastal Studies for over 30 years.

In this first State of the Bay Report, we present the initial results of our Cape Cod Bay Monitoring Program. With water quality stations located from Provincetown to Plymouth and along the entire shoreline, we are establishing the baseline condition of the Bay in order to understand what current and future impacts may occur from our rapidly changing communities.

I invite you to read and learn more about this special place in the marine world deserving of our attention, appreciation and protection.

Sincerely,

Richard F. Delaney
Executive Director, PCCS
Introduction

Theresa M. Barbo, M.A.
Director, Cape Cod Bay Ocean Sanctuary Program

By mere definition, Cape Cod Bay is a bay because land borders water on three sides. Beyond the dictionary, our Bay, the southernmost region of the Gulf of Maine, measuring 604 statute square miles, is alive, vibrant and vigorous. Clearly, Cape Cod Bay is many things to the many people, constituencies and communities who use the resource in endless ways as a playground, workplace, highway, classroom, laboratory, and Zen zone, and once even a war zone between two nations in the early 19th century.

Cape Cod Bay owns a closet full of dressy hats to note its cross-jurisdictions: a State Ocean Sanctuary, from which the Sanctuary program at PCCS draws its name and inspiration; a federally-designated Critical Habitat for the North Atlantic right whale; four Areas of Critical Environmental Concern, among the main ones.

Another hat is in production. On deck is a plan to request that the Environmental Protection Agency stipulate that Cape Cod Bay become a No Discharge Area, which would prohibit the release of treated or untreated sewage into the Bay. I am proud to be a member of the No Discharge Area Work Group.

The Cape Cod Bay Ocean Sanctuary Program is a year-old conservation initiative to inform the public and decision makers about the natural resources of the Bay through special events and publications; to advise local, state and federal resource managers about this unique marine environment - and we do this through the Cape Cod Bay Council drawn from the ranks of concerned citizens, local, state and federal resource managers and non-profit organizations. We value collaboration with other agencies, organizations and institutions to preserve Cape Cod Bay.

Cape Cod Bay’s currents swirl in a counter-clockwise fashion. After the Boston Effluent Tunnel opened in September 2000, the Massachusetts Water Resource Authority released a report depicting the seasonal cycles of Cape Cod Bay:

In November through April, winds and cooling mix the waters of the Bay. Nutrients are plentiful, but in December and January the penetration of light into the water is rarely enough to support the growth of phytoplankton (microscopic floating algae at the base of the food web). As the days lengthen in early spring, increases in light and in nutrient levels trigger the rapid growth of phytoplankton. The spring bloom of phytoplankton starts in the shallower waters of Cape Cod Bay, providing food for zooplankton (tiny animals, including juvenile forms of animals like fish and jellyfish, and abundant tiny crustaceans called copepods) carried into the Bay by strong currents from the Gulf of Maine. In turn, the fast-multiplying zooplankton provide food for many marine species including the northern right whale. A single right whale feeding in Cape Cod Bay can consume about one ton of these plankton daily. Later in the spring, the surface waters of the Bay warm and stratify. The phytoplankton grow abundantly at the surface, where they receive ample light. Because vertical mixing is prevented by stratification, the nutrients at the surface do not get replenished from the bottom waters. The phytoplankton use up the nutrients in the surface water and die, eventually sinking to the bottom and providing food to the bottom-dwelling animal communities which show a growth spurt in mid-summer.

In the water column, bacteria use up dissolved oxygen through their respiration as they consume the dead plankton; the lowest dissolved oxygen levels in the Bay occur from August to October. In the fall, cooling of surface waters and strong winds allow mixing throughout the water column, bringing fresh nutrients to the surface, stimulating a new growth of phytoplankton—the fall bloom. By mid-winter, light levels have declined, ending the fall bloom. The plankton die and decay, releasing nutrients. Nutrient levels increase throughout the water column, preparing the Bay for the next spring bloom.
Science aside, as a historian I call Cape Cod Bay ‘America’s Frontier Ecosystem’ since the country’s maritime and cultural history was borne in its waters. Could you look at a huge ecosystem the size of our Cape Cod Bay and not wonder about its history and heritage?

The nation’s first democratic document, the Mayflower Compact, was signed in Provincetown Harbor in November 1620, and before then, Native Americans walked the dynamic shores to travel, sun-cure fish, harvest shell fish, and forage. Whaling, evolved by Nantucket captains, originated on Cape Cod Bay when Native Americans stripped the flesh from a whale carcass which had washed up on shore.

Native Americans hiked around the embayment often. By the time three Pawmet tribesmen walked the 60-mile path between Pawmet (now Truro) and Plimoth in 1621 to announce the arrival of the *Fortune*, one of the first ships in the New World since the *Mayflower*, the footpath was well used. That slim wisp of a dirt trail, so goes another legend, was used by Native Americans in 1627 to carry word from Nauset to Plimoth that the *Sparrow Hawk* had wrecked in a storm.

Once a 12”-wide 17th century footpath snaking into virgin forest full of bears and wolves, today the Old King’s Highway also known as Route 6A stretches 34 miles along the Cape’s Northside, and the road which once accommodated stage-coaches has grown into the nation’s largest contiguous historic district which borders Cape Cod Bay.

The British knew Cape Cod Bay well during the War of 1812 and used the ecosystem to their advantage against Americans. For the captain of the British warship *Spencer*, which patrolled in the Bay then, tightening the noose around Brewster’s neck in September 1814 seemed almost pleasurable. “I call upon you to come forward with a contribution for the preservation of your salt works, which as I consider of great public utility, will be destroyed,” wrote Commodore Rich Ragget. Four thousand dollars, according to Ragget, is all it would take to save Brewster’s salt works. (Hundreds of acres of salt works once dotted Cape Cod’s shoreline.) Brewster paid the extortion money over a month later after taxing nearly everything in sight, upon a recommendation by the Committee on Safety, including salt works, “buildings of every description, and vessels owned in this town of every description frequenting, or lying on, shores,” said the noted 19th century Historian Frederick Freeman.

Closer to our time, there is even, swears an old native Cape Codder, a German World War II submarine somewhere at the bottom of Cape Cod Bay, sunk by American forces during a clandestine mission. I suppose only a seafloor mapping project will either confirm or refute that rumor. Cape Cod Bay is more than a place to fish, transit, or recreation. Indeed, Cape Cod Bay forms a critical element in Cape Cod history and its maritime culture, and is a jewel of our natural world.

Today, ideas and plans to foster stewardship and sustainability on behalf of Cape Cod Bay continue on many fronts. Donald Liptack, district conservationist for the local USDA Natural Resources Conservation Service which hosts an office in Hyannis, is an expert in watershed restoration. Our progressive, local institution of higher learning, Cape Cod Community College, is forging new pathways with its Environmental Technology Program managed by Stephanie Brady, senior special program coordinator, under leadership by CCCC President Dr. Kathleen Schatzberg. Brenda Boleyn advocates through her role on the Committee for the Conservation of Horseshoe Crabs.

The Cape Cod Stranding Network, which has merged recently with the International Fund for Animal Welfare, has had a busy year. Massachusetts Audubon’s Wellfleet Bay Wildlife Sanctuary, under the watchful eye of Director Robert Prescott, is a vital dynamic on Cape Cod Bay. And great things are happening along the Bay in Brewster at the Cape Cod Museum of Natural History led by Executive Director Robert Dwyer. While none of the above individuals have contributed to this report, their roles in sustaining the Bay are critical.

Within the measure of this first-ever *State of the Bay 2007 Report* you will read the perspectives, expertise, learned opinions of resource managers, hence, the inspiration for the report’s Part II theme, *A Chorus of Conservation*. The contributors answer the question of why we should care about this ecosystem. While not meant to be a comprehensive overview of every issue, concern or conservation project on Cape Cod Bay, their words will no doubt resonate for you, expand the body of knowledge about this special ecosystem, and engage us all further in Cape Cod Bay’s conservation.
PCCS on Cape Cod Bay

Tanya Gabettie
Communications Coordinator

Cape Cod Bay is ecologically rich with a diverse array of coastal and marine habitats. For over 30 years, PCCS has been conducting marine research in Cape Cod Bay through its various bay-related programs. During the coldest days of January, through mid-May PCCS scientists and researchers focus on the critically endangered North Atlantic right whale. Right Whale Habitat Studies and Aerial Survey programs are directed by Ph.D’s and specialists in their respective fields.

About 400 North Atlantic right whales are known to exist world-wide. Right whales migrate between rich spring and summer feeding grounds and warm winter calving areas. By late winter and early spring, right whales appear off the Massachusetts coast, including Cape Cod Bay, to feed. Zooplankton (microscopic aquatic organism) plays an integral role in the marine food web, acting as a link in the transfer of energy from plant matter (phytoplankton) to higher trophic levels. Zooplankton are abundant in Cape Cod Bay during the late-winter and spring, when the right whales arrive in the Bay, in search of food.

For over 25-years, PCCS has investigated the factors that make Cape Cod Bay a critical habitat for right whales. During winter and spring, aboard the R/V Shearwater, Dr. Charles “Stormy” Mayo and the Habitat Studies team conduct weekly cruises to monitor the distribution of right whales in relation to food resources in Cape Cod Bay. At sampling stations throughout the Bay, research activities include zooplankton and phytoplankton plankton sampling, as well as oceanographic data collection (e.g., salinity, ambient light, and temperature.)

The occurrence of different zooplankton species is tied to such environmental factors as temperature, salinity and availability of their prey, including phytoplankton and other zooplankton. These factors change through the seasons and throughout the Bay. The diversity and density of zooplankton differs over time and space, allowing for the development of a complex picture of the factors that influence the occurrence, aggregation, and health of the remaining right whales.

By studying the relationship between right whales and the zooplankton patches on which they feed, in some cases it is possible to predict the distribution patterns of whales. If distribution patterns are accurately portrayed, human activities can be managed to avoid the co-occurrence of whales and human risks such as shipping and fishing activities.

PCCS scientists hope that a clearer understanding of this important habitat will inform conservation efforts for this critically endangered species.

Cape Cod Bay is not the only known feeding ground of right whales, but it is the only known habitat where the whales are known to feed at all depths of the water column, including the sea surface, which places them at elevated risk of vessel strike and mouth entanglement in fixed fishing gear. The complementary program to Habitat Studies is the Aerial Survey Program, initiated in Cape Cod Bay in 1998 and directed by Nathalie Jaquet, Ph.D.

From January through mid-May, aboard a Cessna Skymaster aircraft, Dr. Jaquet and her team document right whales within Cape Cod Bay. Photo-identification techniques are used to identify individual whales, but these surveys also provide valuable data regarding population distribution. Researchers are also able to examine whales from a different perspective for evidence of scarring and entanglements in fishing gear.

The Massachusetts Department of Marine Fisheries supports both Habitat and Aerial Survey Programs.

PCCS keeps a close eye on the coast as well. Senior scientist and Center co-founder Graham Giese, P.h.D., has been studying Cape Cod’s coastal form and processes for over 30 years. Dr. Giese has developed a plan to annually assess on a town-by-town basis, the changes in the sustainability of each Town’s coastal landform system.

Giese’s current project uses a kinematic model to measure sand flow on Cape Cod’s outer coast where no coastal engineering structures such as jetties or sea walls interrupt sediment transport. The Center hopes to expand this study and apply it to Cape Cod Bay in an effort to draft non-invasive, economical and responsible management solutions to coastal erosion issues which affect the Bay.