Casco Bay Estuary
PARTNERSHIP

Casco Bay
PLAN 2016–2021

Casco Bay Estuary Partnership: Catalyst for a Healthy Bay

The Casco Bay Estuary Partnership (CBEP) mobilizes collective action to strengthen the Bay's ecological and economic vitality, fostering a shared commitment to Casco Bay. It focuses scientific expertise and financial resources on helping watershed communities address regional challenges such as water pollution, habitat degradation and adaptation to climate change.

Since Casco Bay was named an "estuary of national significance" in 1990, CBEP has served as a convener and information hub—engaging individuals, organizations and government agencies in shared actions to sustain Casco Bay. CBEP is one of 28 community-based partnerships that participate in the National Estuary Program of the US Environmental Protection Agency (US EPA).

Bailey Island, *Katie Wheeler*
Cover Image: Willard Beach, *Cara Slifka*

Working Together on Behalf of Casco Bay

Casco Bay is a natural asset of significant ecological and economic value. With its rich maritime traditions and abundant recreational offerings, the Bay defines our sense of place and enriches our lives in countless ways. It also acts as a magnet—drawing new jobs, investments and creativity.

For two decades, the Casco Bay Estuary Partnership has guided efforts to sustain a healthy Bay: protecting key habitats, improving water quality, and encouraging sound stewardship. This collective work on behalf of the Bay has yielded many positive outcomes—like cleaner swimming beaches and more shellfish beds open to harvesting. But stressors on the Bay are changing in character and growing in number and magnitude.

This latest *Casco Bay Plan (2016–2021)*, developed in association with many organizations and agencies, outlines Goals, Strategies and Actions for the coming years. As you read through these pages, please consider which of these Actions you can help to advance. We hope that elected officials, the business community, nonprofit groups, educational institutions and residents will all step forward. Sustaining Casco Bay's vitality in the coming years depends on the active engagement of many watershed residents—including, we hope, you.

Curtis Bohlen
Director, Casco Bay Estuary Partnership

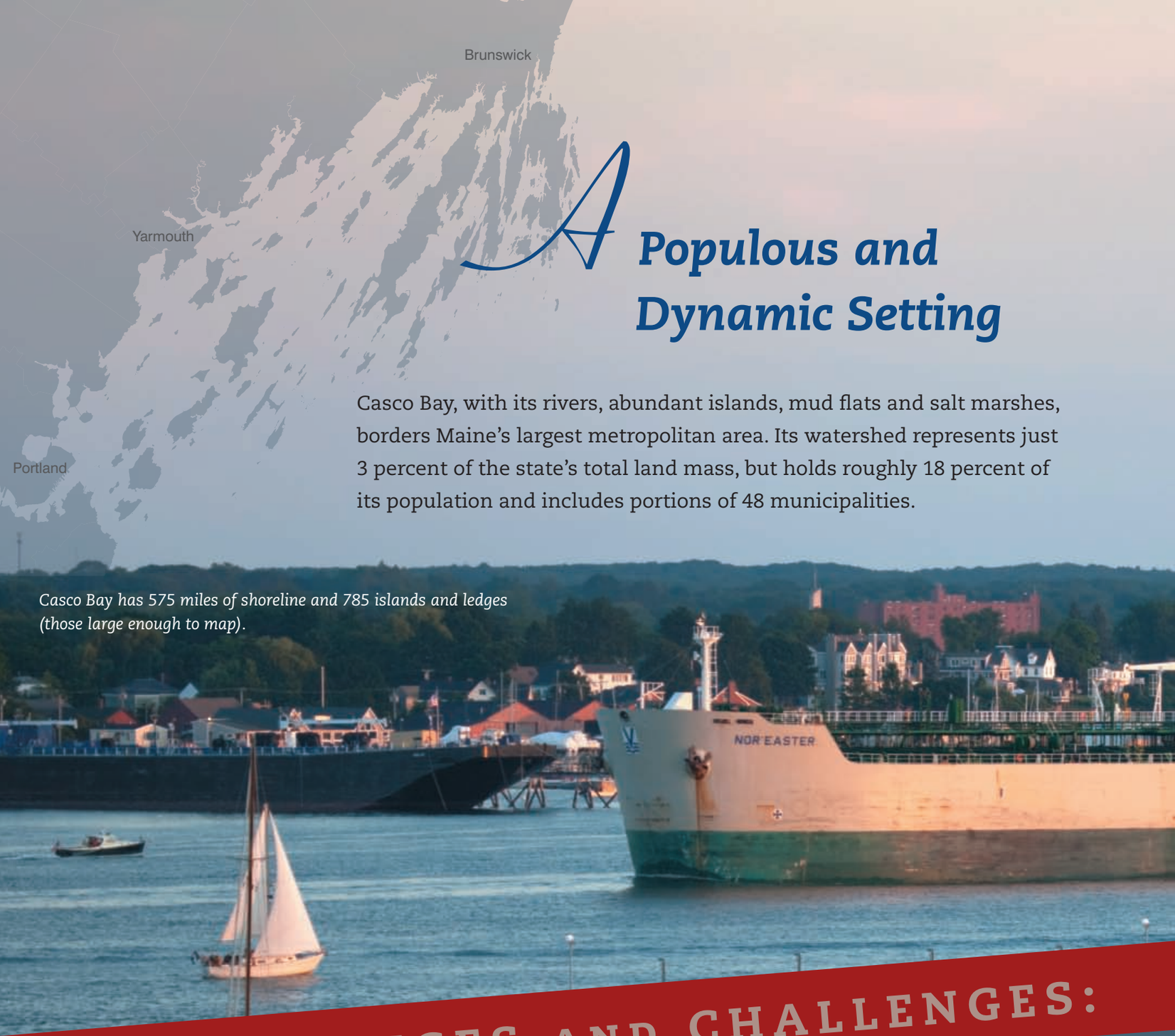
The Partnership's Guiding Vision

1. ***Enhance Casco Bay:*** focus on actions that increase the Bay's well-being—improving marine ecosystems, economic vitality and the region's quality of life
2. ***Drive innovation:*** catalyze creative, cost-effective and enduring environmental solutions that are grounded in good science and meet community needs
3. ***Work collaboratively:*** build on the collective strength of diverse interests, advancing a shared agenda for the Bay
4. ***Link people and place:*** foster widespread appreciation of the Bay's ecological and economic values, and inspire residents, businesses and municipalities to adopt practices that reduce their impacts on Casco Bay
5. ***Build capacity and understanding:*** provide training and broadly disseminate information on Bay-related research, community initiatives, educational programs and volunteer opportunities
6. ***Adapt as conditions change:*** foster regional resilience—the capacity for ecosystems and economies to adapt as climate and other variables shift, and to bounce back from unexpected disruptions

Corey Templeton

A Populous and Dynamic Setting

Casco Bay, with its rivers, abundant islands, mud flats and salt marshes, borders Maine's largest metropolitan area. Its watershed represents just 3 percent of the state's total land mass, but holds roughly 18 percent of its population and includes portions of 48 municipalities.



Casco Bay has 575 miles of shoreline and 785 islands and ledges (those large enough to map).

CHANGES AND CHALLENGES:

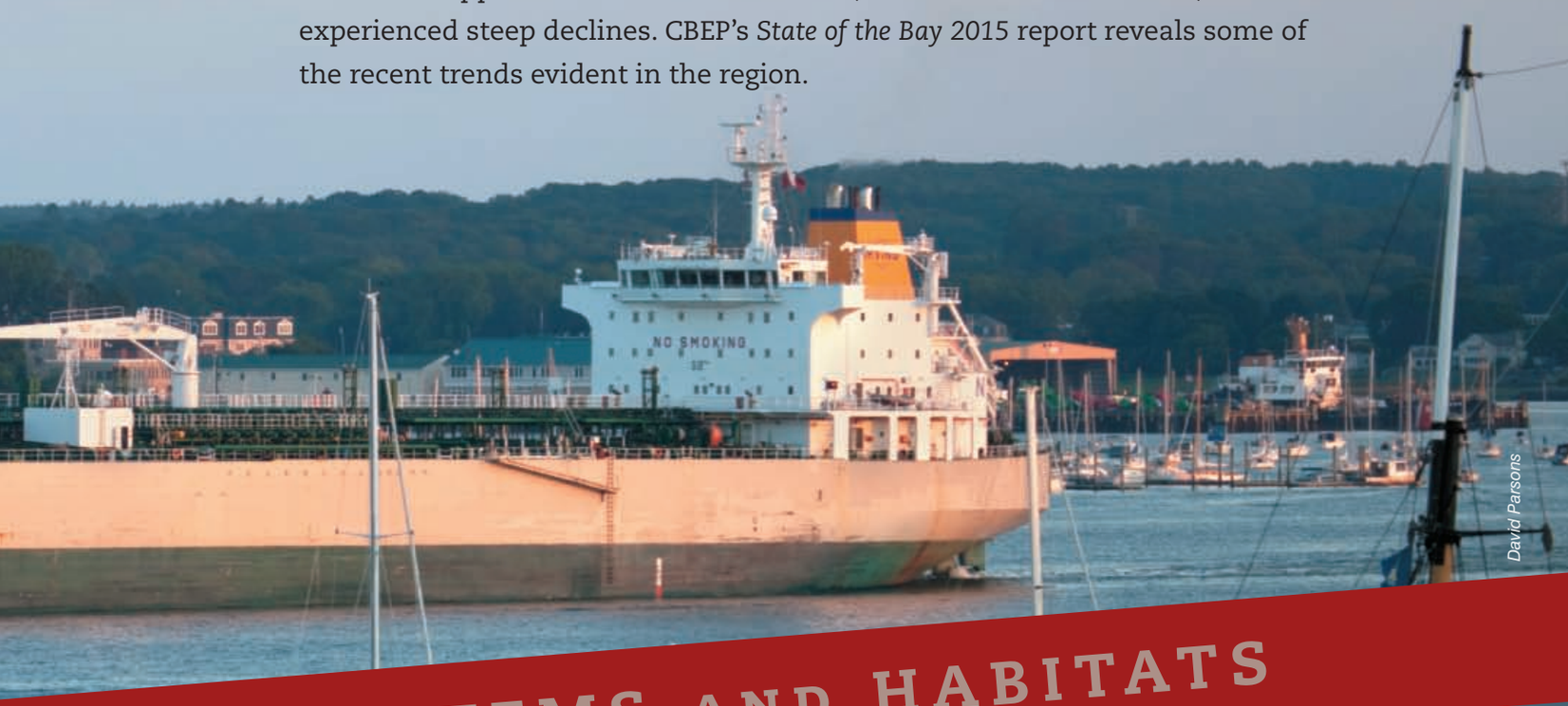
Development Pressures: The region's population is growing, with much of the new development dispersed in suburban and rural villages and towns—disrupting wildlife habitat and contributing to stormwater runoff pollution. Development pressure on waterfront land drives up property values, making conservation of shorelines expensive.

Disruptions to the Marine Food Web: Marked declines in wild-caught fisheries (particularly large, predatory species) and in the population of clams and mussels may be causing major shifts in the Bay's food web.

Rob Kleine

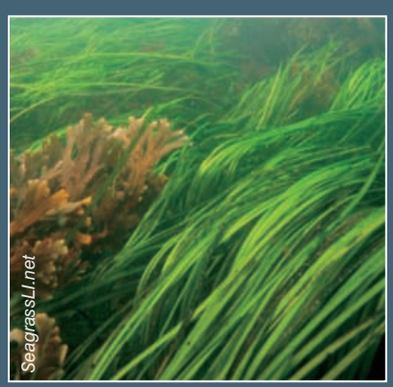
Casco Bay has abundant maritime trades, a strong lobster fishery, and more than 800 documented marine species. The region's residents enjoy the many recreational amenities it offers, including swimming, boating, fishing, clamming and wildlife-watching. By national standards, Casco Bay is relatively healthy.

Yet the Bay is far from pristine. Roadways, lawns, wastewater treatment plants and air pollution contribute excess nutrients and toxics to marine ecosystems. Development can fragment the landscape, reducing wildlife habitat. Species that once supported iconic Maine fisheries, such as cod and haddock, have experienced steep declines. CBEP's *State of the Bay 2015* report reveals some of the recent trends evident in the region.



David Parsons

ECOSYSTEMS AND HABITATS


SeagrassLI.net

Loss of Eelgrass Beds: Between 2001/2002 and 2013, Casco Bay lost more than half of its eelgrass beds—which provide essential habitat for waterfowl and many marine organisms, and help protect water quality.

Changes in Fisheries: Aquaculture operations in Casco Bay (involving oysters, kelp and blue mussels) are growing in number while once-abundant species like cod are increasingly rare. Heavy reliance on the lobster industry makes coastal economies vulnerable should something threaten Maine's iconic shellfish species.

Influx of Invasive Species: The number of non-native species is increasing. A 2013 "rapid assessment" by scientists at two Casco Bay locations found that between one-fifth and one-third of all identified marine species were not native.

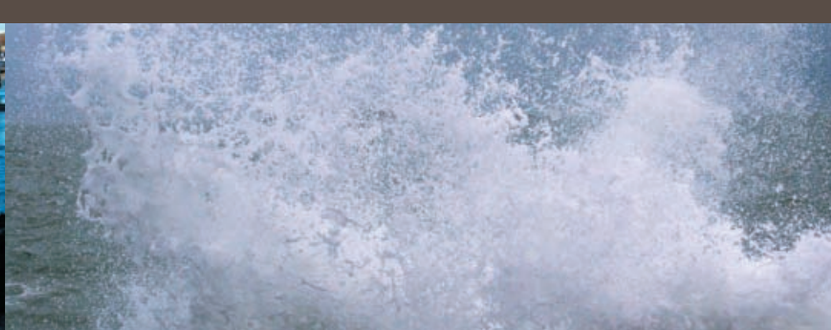
Facing Unprecedented Change

Climate change has begun transforming Casco Bay's ecological and economic systems, creating new management challenges that span from transportation and fisheries to public health. Climate stressors can exacerbate existing problems such as water pollution, habitat degradation and the proliferation of non-native species. And they will continue reshaping the region in unpredictable ways for generations.

CHANGES AND CHALLENGES:

Rising Air Temperatures: Worldwide, 2014 was the warmest year on record, part of an upward trend that could raise air temperatures in Maine between 2° and 6°F by mid-century (with the average number of extremely hot days—those with a heat index equal to or greater than 95°F—increasing from 4 to 13.5 annually).

Intensifying Precipitation: Maine is experiencing increases in both annual precipitation and extreme precipitation events, raising concerns about flooding and stormwater impacts. Stormwater runoff carries excess nitrogen and phosphorus into marine waters—aggravating coastal acidification, lowering dissolved oxygen (leading to fish kills), stimulating harmful algal blooms, and altering ecological communities.



Even short-range planning must address this inherent uncertainty: assumptions based on the past are no longer a reliable guide. In the future, residents will continue to benefit from the Bay's assets, but the composition of fisheries and industries, the variety of wildlife, and the threats that take precedence may differ markedly from those outlined in this Plan.

The *Casco Bay Plan* must be able to respond as circumstances change. CBEP monitors and reports on changing conditions in Casco Bay, and commits to reevaluating the Plan's Actions in light of new information.

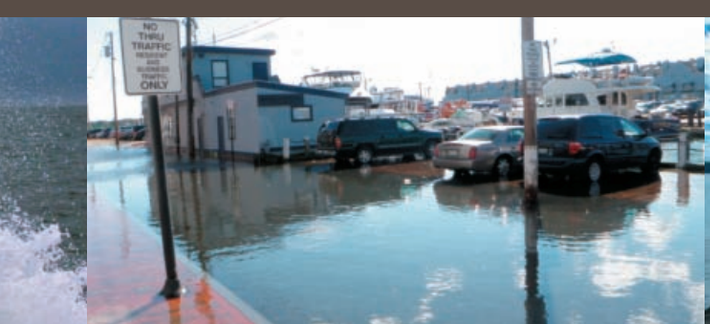
Carol Blyberg

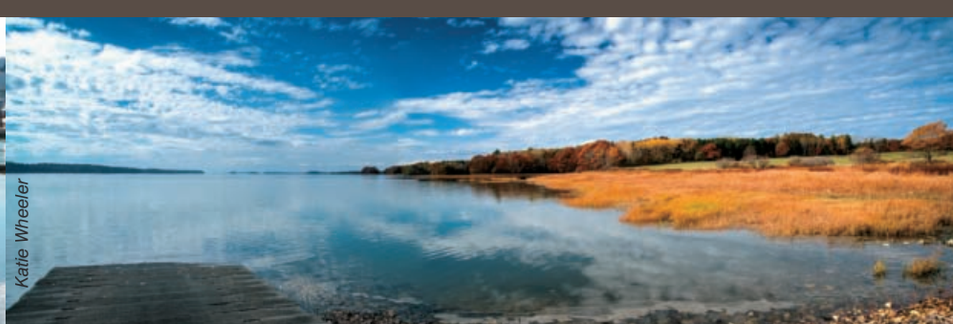
CLIMATE STRESSORS

Warming Ocean Temperatures: Between 2004 and 2013, according to a *Science* article in press (see references), the Gulf of Maine has been warming faster than 99 percent of the global ocean.

Acidifying Coastal Waters: When marine waters absorb carbon dioxide, they become more acidic, experiencing changes in water chemistry that make it more difficult for juvenile shellfish to build and maintain shells. According to a Maine Legislative Commission report, the ocean is acidifying at a rate at least 100 times faster than at any other time in the past 200,000 years.

Rising Seas: The Maine Geological Survey currently estimates that Casco Bay will experience at least a 2- to 4-foot rise in sea level by the end of this century, causing increased coastal flooding, erosion, infrastructure damage, and threats to valuable coastal wetlands.





Katie Wheeler

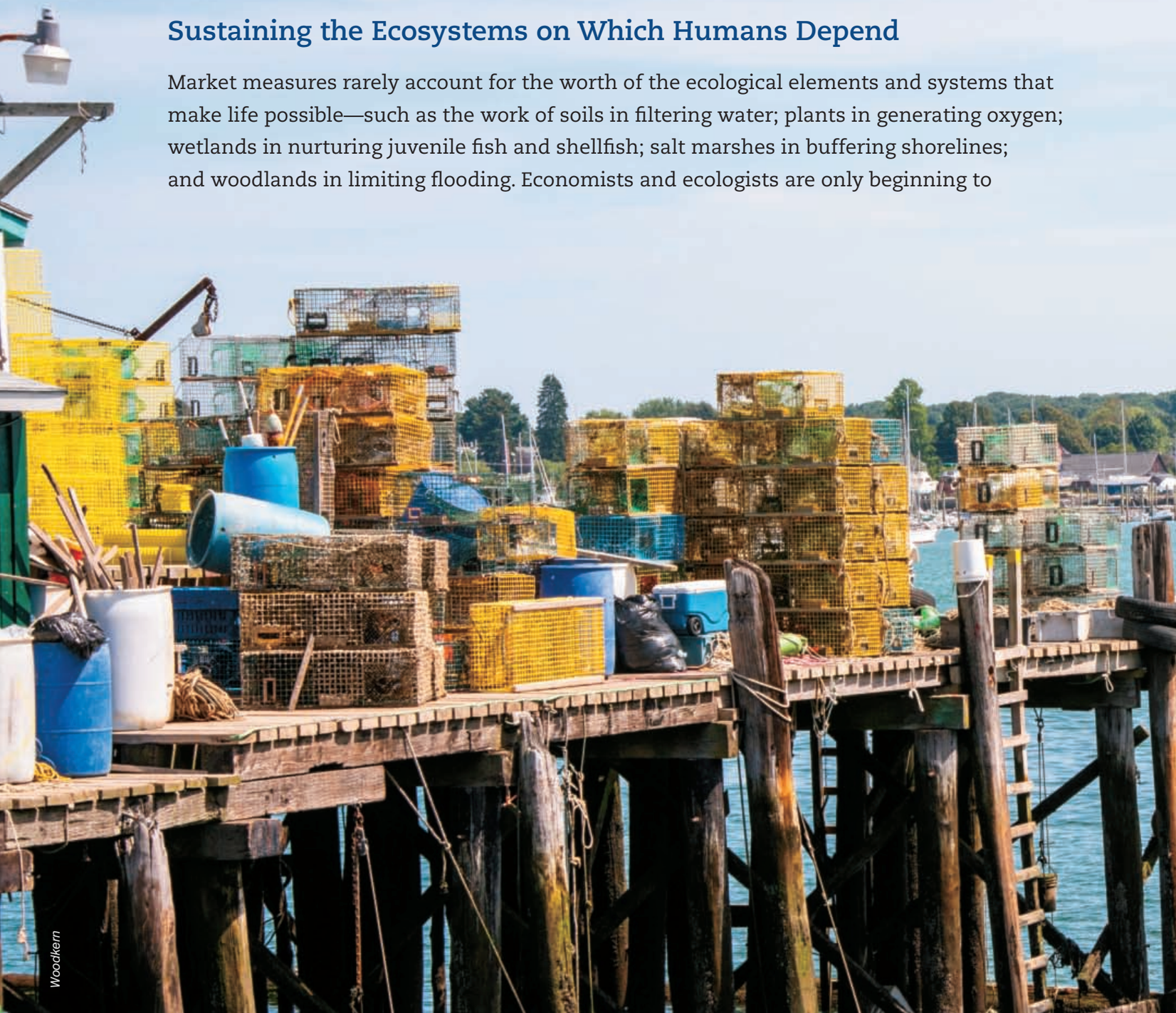
Casco Bay's Inestimable Worth

Driving the Region's Economy

According to NOAA, ocean-related businesses in 2012 provided 9.5 percent of the total jobs in Cumberland County (which aligns closely with the Casco Bay watershed), a 27 percent increase in ocean jobs since 2005. Friends of Casco Bay estimated the value of activities such as fishing, marine-related tourism and marine trades on and around the Bay to be $628 million in 2011. Monetary calculations of marine products and services do not include all the economic benefits that the Bay brings to the region—such as attracting new residents, visitors and enterprises.

Sustaining the Ecosystems on Which Humans Depend

Market measures rarely account for the worth of the ecological elements and systems that make life possible—such as the work of soils in filtering water; plants in generating oxygen; wetlands in nurturing juvenile fish and shellfish; salt marshes in buffering shorelines; and woodlands in limiting flooding. Economists and ecologists are only beginning to



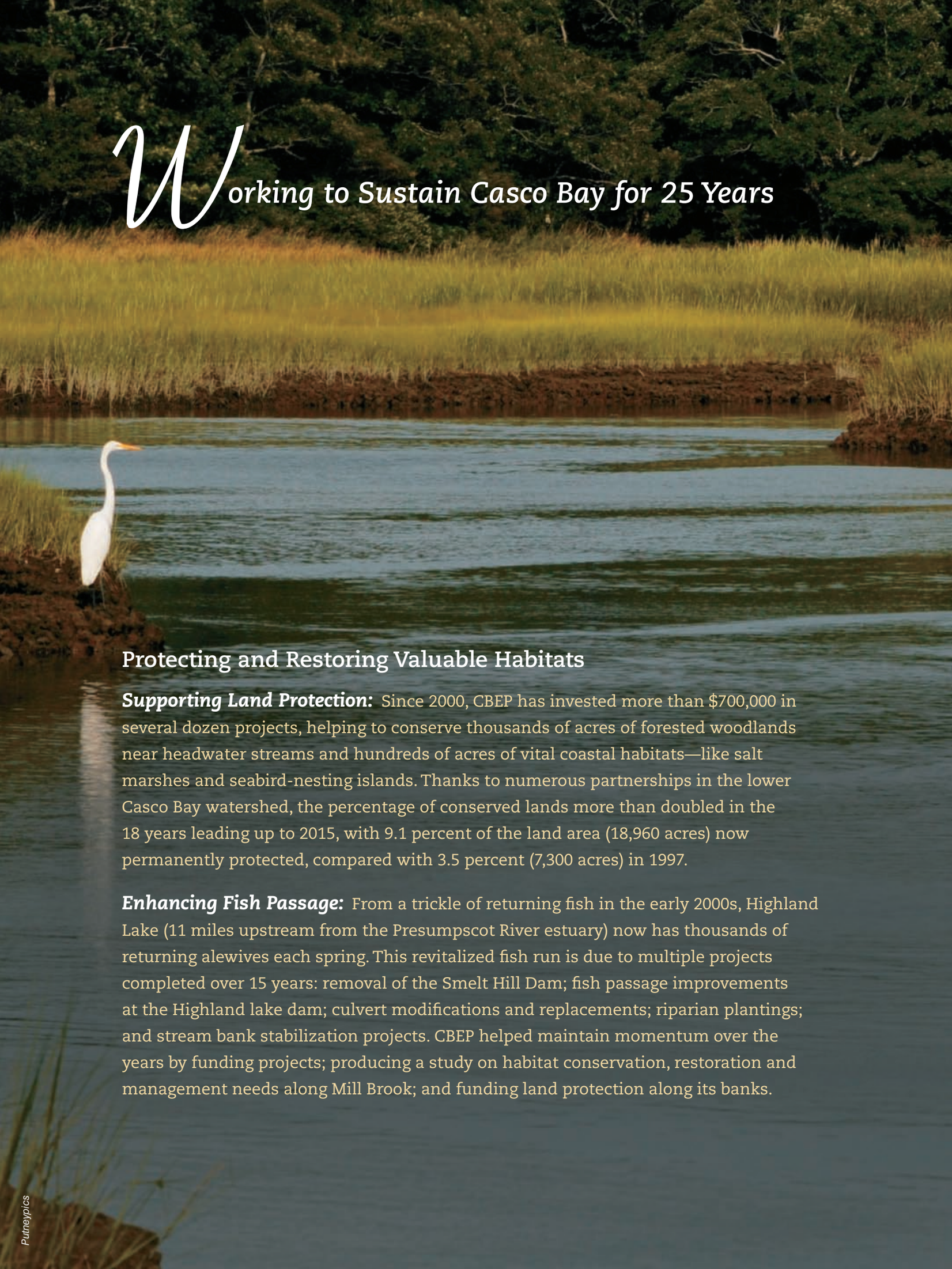
Woodkern

estimate the financial significance of the gifts that natural ecosystems offer. A 2012 study commissioned by Manomet Center for Conservation Sciences estimated the annual value of the diverse ecosystem functions within Cumberland County to be between $800 million and $2 billion.

Enhancing Quality of Life

The true value of Casco Bay to area residents and visitors extends farther still. The Bay holds inestimable cultural, recreational, aesthetic and spiritual importance to those who live or spend time along its shores. With its fisheries, shipping trade, summer colonies, maritime industries, military history, and famed Calendar islands, Casco Bay has left a large and indelible imprint on the region's literature, history and way of life. The region is what it is because of the Bay.

Peter Taylor (2)



Working to Sustain Casco Bay for 25 Years

Protecting and Restoring Valuable Habitats

Supporting Land Protection: Since 2000, CBEP has invested more than $700,000 in several dozen projects, helping to conserve thousands of acres of forested woodlands near headwater streams and hundreds of acres of vital coastal habitats—like salt marshes and seabird-nesting islands. Thanks to numerous partnerships in the lower Casco Bay watershed, the percentage of conserved lands more than doubled in the 18 years leading up to 2015, with 9.1 percent of the land area (18,960 acres) now permanently protected, compared with 3.5 percent (7,300 acres) in 1997.

Enhancing Fish Passage: From a trickle of returning fish in the early 2000s, Highland Lake (11 miles upstream from the Presumpscot River estuary) now has thousands of returning alewives each spring. This revitalized fish run is due to multiple projects completed over 15 years: removal of the Smelt Hill Dam; fish passage improvements at the Highland lake dam; culvert modifications and replacements; riparian plantings; and stream bank stabilization projects. CBEP helped maintain momentum over the years by funding projects; producing a study on habitat conservation, restoration and management needs along Mill Brook; and funding land protection along its banks.

Putneypics

Over the past quarter-century, a strong collaboration has evolved among the municipalities, nonprofit organizations, scientists, residents and government agencies that share a vision for a healthy Casco Bay. Many of the actions outlined in this Plan grow out of the work these community partners have accomplished—protecting and restoring habitats, improving water quality, tracking change, and fostering Bay stewardship. Their collective successes form a solid foundation for the work that lies ahead.

Mapping Fish Passage: In partnership with local Trout Unlimited chapters and the US Fish and Wildlife Service's Gulf of Maine Coastal Program, CBEP developed an atlas of road-stream crossings throughout the Casco Bay watershed, featuring town-by-town maps showing fish passage barriers and severely undersized structures that could pose a flooding risk. Volunteers and interns assessed nearly 1,500 road crossings and dams in this multi-year project.

Revitalizing Tidal Marshes: At several locations in Harpswell and Brunswick, CBEP and partner organizations helped revitalize more than 50 acres of valuable tidal wetland habitat, restoring tidal flow by working with municipalities, local partners and the Maine Department of Transportation to replace undersized culverts and upgrade road crossings. CBEP is monitoring these marsh restoration projects to better understand how sea-level rise may affect tidal wetlands.

Helping Manage Regional Watersheds: Through work with the Presumpscot River Watershed Coalition, CBEP helped develop *A Plan for the Presumpscot River* and successfully completed a $1-million dollar project under the US EPA's Targeted Watershed Grants Program. CBEP also supported the Coalition in identifying shared land-conservation priorities for the region, and in producing a Presumpscot River map and paddling guide. The New Meadows Watershed Partnership is doing similar work to protect the ecological and economic resources of the Eastern Bay.

Collaborating for Cleaner Waters

Eliminating Combined Sewer Overflows (CSOs): Portland and South Portland led efforts to reduce CSO discharges, investing in substantial infrastructure improvements. The number of active CSO outfalls around Casco Bay fell from 80 in 1990 to 43 by 2014. Whereas 24.9 million gallons of untreated wastewater discharged from CSOs per inch of rainfall in 2000, only 7.9 million gallons discharged per inch of rainfall in 2014.

Reducing Stormwater Pollution: In 2002, CBEP and Cumberland County Soil and Water Conservation District co-founded the Interlocal Stormwater Working Group (ISWG), a regional partnership in which 14 municipalities share strategies for reducing stormwater pollution and complying with related Clean Water Act permits. ISWG communities work cooperatively to educate youth, municipal officials, developers and citizens about water quality and stormwater.

Improving Urban Waterways: CBEP was instrumental in creating and it continues to support the Long Creek Watershed Management District, a pioneering national model for cleaning up damaged urban waterways (featured in a US EPA Long Creek video). Serving more than 130 private businesses, the nonprofit District has completed several stream restoration projects, and established Maine's most comprehensive monitoring program for an urban stream.

Keeping Waters Safe for Swimming: The US EPA designated Casco Bay as Maine's first "No Discharge Area," prohibiting discharge of all vessel sewage into Bay waters. State legislation controls gray water from large commercial passenger vessels, making Maine's coastal waters some of the nation's best protected against vessel discharges. Thanks to the presence of 23 shoreside facilities and the Friends of Casco Bay mobile pumpout boat, it's easy for boaters to comply with these protective measures.

Cara Slifka

Monitoring Water Quality: CBEP helped launch and sustain Friends of Casco Bay's water-quality monitoring program, which engages more than 80 citizen volunteers in testing at about 40 locations for temperature, salinity, dissolved oxygen and pH. The Partnership also funds Presumpscot River Watch, which has been marshalling volunteers since 1989 to monitor water quality.

Reducing Shellfish Bed Contamination: Since its formation, CBEP and partner groups have helped protect coastal water quality and ensure safety of Casco Bay shellfish harvests—commissioning studies to identify sources of bacterial contamination; sponsoring shoreline survey training for local officials; training those who install and repair septic tanks; and funding local weather stations that allow for more precise shellfish-bed closures in response to rain events.

Encouraging Stewardship and Research

Fostering Stewardship: Many of the region's residents give back to Casco Bay through volunteer stewardship work with land trusts, conservation commissions, nonprofit organizations, and schools. CBEP's small-grant program has funded volunteer projects such as riparian forest planting and invasive plant eradication. With CBEP support, Youth Conservation Corps teams have completed stewardship projects addressing water quality and habitat challenges throughout the lower watershed.

Supporting Applied Science and Research: CBEP has commissioned or conducted more than a dozen studies (available through the CBEP website publications library) to help provide a sound scientific basis for managing Casco Bay. Examples include:

- *Osprey Nest Abundance, Distribution and Productivity in Casco Bay* (2012);
- *Review of Circulation Studies and Modeling in Casco Bay* (2011); and
- *Toxic Pollution in Casco Bay: Sources and Impacts* (2007).

Studying Effects of Climate Change: To help assess the region's vulnerability to sea-level rise and storm surge, CBEP commissioned an in-depth economic assessment that demonstrated the benefits of planning for future flood risks. Another study examined the vulnerability of Casco Bay's tidal wetlands to sea-level rise, finding that many wetlands could migrate into adjacent low-lying lands if faced with moderate increases in sea level. CBEP provided reports to local planners showing areas of probable future inundation. With US EPA funding, the Northeast Coastal Acidification Network, Southern Maine Community College, University of New Hampshire, and CBEP established Casco Bay's first ocean acidification monitoring station in 2015.

Tracking the Spread of Invasive Species: Every three to four years since 2000, CBEP has joined with other National Estuary Programs in New England, Massachusetts Institute of Technology Sea Grant, and the Massachusetts Office of Coastal Zone Management to conduct a Rapid Assessment Survey of marine invasive species on floats at ferry terminals and marinas. CBEP is expanding early detection of invasive species within Casco Bay through work with the Marine Invader Monitoring and Information Collaborative (MIMIC). In 2015, MIMIC volunteers monitored four Bay locations, including the only two island-based sites in the Maine MIMIC network. CBEP helped establish the Casco Bay Invasive Species Network, a regional network of conservationists, land managers and other professionals dedicated to awareness and management of non-native invasive species.

Cara Slifka

Looking Ahead: Goals of the Casco Bay Estuary Partnership

Guided by the *Casco Bay Plan 2016–2021* (which builds on the original 1996 Plan and a 2006 Plan Update), CBEP will focus on four primary Goals that extend the scope and impact of the collective work already underway on behalf of Casco Bay.

1. ***Protect, restore and enhance key habitats that sustain ecological health***

   CBEP commits to conserving priority undeveloped shorelines, protecting and restoring vital habitats such as eelgrass beds and tidal mudflats, enhancing connectivity among aquatic habitats, and strengthening the capacity of Casco Bay ecosystems to accommodate change.

2. ***Improve Casco Bay's water quality by reducing nutrient pollution and its impacts, including coastal acidification***

   CBEP promotes practices that reduce nutrient pollution, support public funding for improved stormwater management, and assess the dynamics of how nutrients enter and move within Casco Bay.

3. ***Foster resilient communities and their connections to Casco Bay***

   CBEP seeks to increase public engagement with Casco Bay and to support collaborative initiatives that illuminate the region's ecological and economic interconnections, celebrate the Bay's importance, and help citizens and leaders increase the region's resilience in the face of climate disruptions.

4. ***Mobilize collective knowledge and resources to support Casco Bay***

   CBEP serves as a convener and catalyst, mobilizing scientific, financial and human resources to help residents throughout the watershed effectively address the complex and evolving challenges facing Casco Bay.

The *Casco Bay Plan 2016–2021* outlines Strategies and Actions for the coming years (see insert in back cover pocket) that will help sustain the Bay's wealth of natural and cultural amenities. Many organizations and individuals helped develop these Plan Actions, and—for them to succeed—even more individuals, businesses and organizations will need to contribute their skills, energy and expertise.

Bill Abbott

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The online edition of this Plan, at http://www.cascobayestuary.org/resources/publications, includes hyperlinks to materials referenced.

For further reading related to Casco Bay, please visit www.cascobayestuary.org/resources/publications.

For a glossary of terms used in this Plan, please visit www.cascobayestuary.org/resources/planning-for-casco-bays-future.

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Writing: *Natural Choices* **(Marina Schauffler)** ***Design and Production:*** *Waterview Consulting* **(Peter Taylor, Virginia Howe)**

Contributing Partners

The projects accomplished by the Casco Bay Estuary Partnership in its first quarter-century are collective successes—the products of collaborative work involving countless partners. This list cannot acknowledge adequately all those who have contributed to CBEP projects, but highlights some of the many dedicated partners who have contributed their time and talents working on behalf of Casco Bay.

Towns, Cities, and Land Trusts of the Casco Bay Region · Cumberland County Soil and Water Conservation District · Friends of Casco Bay · Greater Portland Council of Governments · Maine Department of Inland Fisheries and Wildlife · Gulf of Maine Research Institute · US Fish and Wildlife Service Gulf of Maine Program · Conservation Law Foundation · Biodiversity Research Institute · Casco Bay Island Development Association · Island Institute · Maine Coastal Program · US Environmental Protection Agency · University of Southern Maine · Portland Water District · Maine Department of Environmental Protection · Friends of the Presumpscot River · Maine Geological Survey · Maine Audubon · Maine Department of Transportation · US Geological Survey · Maine Rivers · National Oceanic and Atmospheric Administration · Presumpscot River Watershed Coalition · The Nature Conservancy-Maine · University of New England · University of Maine · New England Environmental Finance Center · Lakes Environmental Association · New Meadows Watershed Partnership · Maine Island Trail Association · Maine Department of Marine Resources · Presumpscot River Watch · Southern Maine Community College · University of New Hampshire · Bates College · Wells National Estuarine Research Reserve · Maine Sea Grant · Environmental Funders Network · Trout Unlimited · Maine Marine Invasive Species Coalition · Maine Volunteer Lake Monitoring Program · Marine Invader Monitoring and Information Collective · Casco Bay GIS Service Center · Maine Outdoor Heritage Fund · Natural Resources Council of Maine · Board of Pesticide Control · Northeastern Regional Association of Coastal and Ocean Observing Systems

Casco Bay Estuary
PARTNERSHIP

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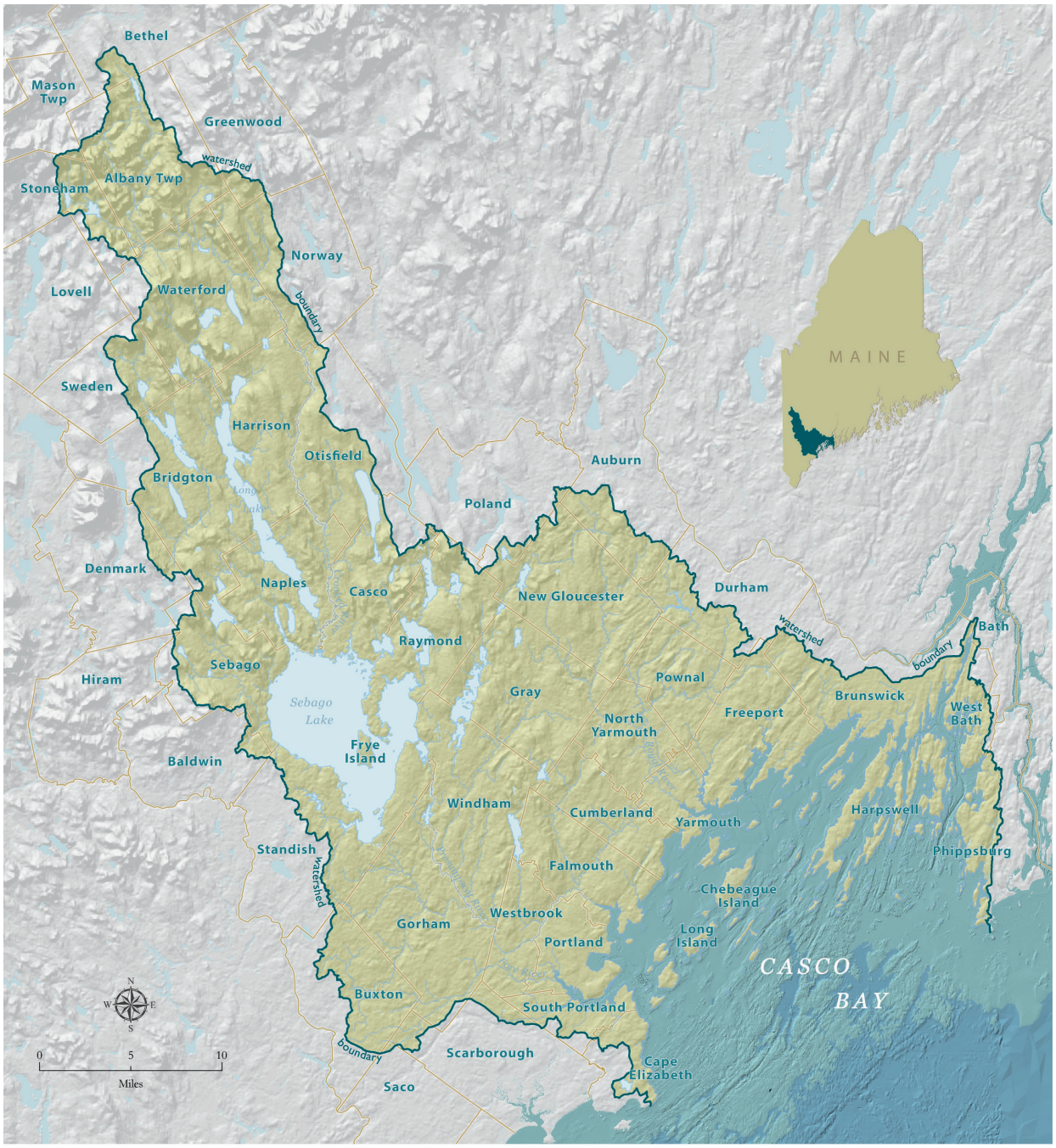
Goals, Strategies *and* Actions

February 5, 2016



Casco Bay Plan 2016–2021

Goals, Strategies and Actions *Page*

Goals, Strategies and Actions *Page*

Goal 1

Protect, restore and enhance key habitats that sustain ecological health

The long-term health of Casco Bay depends on vital habitats that support the Bay's abundant wildlife and commercially valuable fish, shellfish and seaweeds. Connectivity among aquatic habitats is essential to help organisms migrate, withstand climatic extremes and sea level rise, and maintain their populations in the face of established and emerging stressors. Aquatic connectivity and the restoration of natural stream processes benefit human communities as well: rebuilding native ecosystems in rivers, streams and the Bay; decreasing flood impacts; and reducing infrastructure maintenance. Casco Bay Estuary Partnership (CBEP) is committed to fostering connectivity among aquatic habitats; conserving undeveloped shorelines; enhancing, protecting and restoring critical coastal habitats (*e.g.,* eelgrass beds, intertidal areas and tidal mudflats); planning for future migration of tidal marshes (as sea levels rise); and helping strengthen the Bay's ecosystem functions. CBEP takes an ecosystem approach to restoration, focused on geographic sub-regions rather than isolated species or habitat types.

Strategy 1.1: Conserve significant coastal habitats and areas that protect water quality, such as riparian corridors, wetlands and forests adjoining headwater streams

The integrity of Bay ecosystems rests in large part on the persistence of coastal habitats (such as tidal flats, rocky intertidal areas, salt marshes and coastal forests) as well as inland river and stream corridors, freshwater wetlands and upland forests. Even as Casco Bay responds to climate impacts, the watershed will support fish, wildlife and birds. Through conservation projects, land trusts and local governments have made significant progress over the past two decades protecting an extensive network of coastal and inland habitats that help preserve water quality and support a healthy bay. CBEP will continue advancing these efforts in the face of increased development pressures, sea level rise and greater storm frequency and intensity.

Strategy 1.2: Restore and enhance coastal habitats and habitat connectivity that are important to sustaining the health of Casco Bay

Centuries of human impacts have compromised the ability of many coastal habitats to sustain functions that are critical to long-term ecosystem health. Where feasible and cost-effective, habitat restoration and enhancement can counter these cumulative impacts and buffer the effects of climate change. Priority targets in Casco Bay include restoring passage for diadromous fish species (that migrate between fresh and salt water), restoring tidal wetlands (principally by replacing undersized culverts or removing coastal dams), and replanting eelgrass beds. CBEP plans to support testing of emerging technologies (not yet evaluated in Casco Bay) that rely on natural processes to enhance ecosystem health (*e.g.*, living shoreline techniques that stabilize shorelines, or oyster and seaweed cultivation that improves water quality).

Maintain Casco Bay Estuary Partnership Habitat Protection Fund

Goal 1: ***Protect, restore and enhance key habitats that sustain ecological health***

Strategy 1.1: ***Conserve significant coastal habitats and areas that protect water quality, such as riparian corridors, wetlands and forests adjoining headwater streams***

Purpose

Advance protection of aquatic and terrestrial habitats that support the health of Casco Bay

Timeline

Ongoing (assuming available funding)

Key Alliances

- Maine Department of Inland Fisheries and Wildlife
- Maine Coast Heritage Trust
- U.S. Fish and Wildlife Service Gulf of Maine Coastal Program

Other Cooperators

- Land trusts
- Municipalities
- Other state agencies

Description

Casco Bay Estuary Partnership (CBEP) has provided strategic financial support for habitat protection programs since 2000, committing more than $700,000 from its Habitat Protection Fund to help conserve upwards of 10,000 acres (including coastal islands, tidal flats, wetlands and forests). Most of the properties funded allow public access.

CBEP will continue to provide land trusts, municipalities, state agencies and other conservation organizations Habitat Protection Fund grants of up to $30,000 (depending on funding availability) to facilitate permanent habitat protection through acquisition of fee title or conservation easements. Funds can be used to leverage local, federal, or state funding; help cover transaction costs; and support strategic "high-risk, high-reward" or time-sensitive opportunities. Requests for funding will be reviewed by CBEP's staff and Habitat Protection Committee, with representatives drawn from the land trust community and federal and state agencies.

To be eligible, the proposed conservation acquisition must benefit aquatic ecosystems in the Casco Bay watershed. Areas of particular interest include the Bay's shoreline, intertidal habitats, and islands; river riparian areas and floodplains; freshwater wetlands; and forested areas near headwater streams. Natural areas that could accommodate tidal wetland migration (as sea levels rise) or that would protect or enhance sediment supply to tidal wetlands will be considered. Priorities identified within regional conservation plans that have been endorsed by CBEP are also eligible for funding.

Resources

To support 1–3 projects each year would require an annual commitment of CBEP funds on the order of $25,000–$40,000. Limited CBEP staff time is needed to issue Request for Proposals, convene the Habitat Protection Committee, administer grants, and collect project data.

Outputs

- 1–3 habitat conservation grants annually

Outcomes

- Short-term
  - Habitat conservation projects completed
- Medium-term
  - Protection of coastal habitat, wetlands, forests, floodplains, and other areas that contribute to Bay water quality
- Long-term
  - Improvements to Bay's habitats, water quality, ecosystem function and integrity

Metrics and Targets

Metric	*Target*
Percentage of land area among the lower 16 municipalities within the Casco Bay watershed permanently protected by 2020	10%
New habitat acres protected by 2020	1,500
New acres of coastal habitat protected by 2020	200
Number of projects funded per year	2

Assist Habitat Protection Efforts

Goal 1: ***Protect, restore and enhance key habitats that sustain ecological health***

Strategy 1.1: ***Conserve significant coastal habitats and areas that protect water quality, such as riparian corridors, wetlands and forests adjoining headwater streams***

Purpose

Provide technical assistance to facilitate permanent protection of aquatic and terrestrial habitats that support the health of Casco Bay

Timeline

Ongoing

Key Alliances

- U.S. Fish & Wildlife Service Gulf of Maine Coastal Program
- Maine Coast Heritage Trust

Other Cooperators

- Local land trusts
- Maine Land Trust Network
- State and federal habitat funding programs

Description

Casco Bay Estuary Partnership (CBEP) will continue to provide support for a regional GIS (Geographic Information Systems) Service Center which has been housed for more than a decade at the U.S. Fish & Wildlife Service Gulf of Maine Coastal Program office (USFWS GOMCP). Providing habitat analysis and other GIS services, the Service Center provides technical support for 8-12 habitat protection projects each year. It also supports strategic planning by conservation organizations and can assist local entities in building in-house GIS capacity.

The Center continues to meet key regional needs. While some conservation professionals and many consultants now have GIS expertise, numerous regional land trusts have minimal staffing and lack funds to hire GIS consultants.

This Action will be led primarily by organizations central to regional habitat protection such as Maine Coast Heritage Trust and the USFWS GOMCP. In a supporting role, CBEP staff members may help address ongoing training and technical assistance needs such as the mapping, habitat analysis, proposal drafting, grant management and reporting needed to secure federal and state habitat grants (*e.g.,* North American Wetlands Conservation Act, Land for Maine's Future Program, Maine Outdoor Heritage Fund and Maine Natural Resource Conservation Program).

CBEP also may provide direct financial support through its Habitat Protection Fund according to CBEP protection priorities (as articulated in Action 1.1.A and Action 4.2.A).

Resources

This Action requires CBEP funding to maintain the USFWS GOMCP GIS Service Center ($7,500-10,000 annually), as well as staff time to manage related contracts and provide project support. Staff time would be allocated primarily to assist municipalities, land trusts and other organizations with work on specific high-value projects.

Outputs

Habitat protection projects initiated and grant proposals submitted with CBEP assistance

Outcomes

- Short-term
  - Grant funding for habitat protection
- Medium-term
  - Protection of coastal habitats, wetlands, forests, floodplains, and other areas that contribute to water quality
- Long-term
  - Improvements to Bay's habitats, water quality, ecosystem function and integrity

Metrics and Targets

Metric	*Target*
Number of organizations accessing USFWS GOMCP GIS Service Center services	>6
Number of habitat analyses provided by USFWS GOMCP GIS Service Center in support of habitat protection efforts	8 annually

Lead Coastal Habitat Restoration Efforts

Goal 1: ***Protect, restore and enhance key habitats that sustain ecological health***

Strategy 1.2: ***Restore and enhance coastal habitats and habitat connectivity that are important to sustaining the health of Casco Bay***

Purpose

Implement projects that restore coastal habitats

Timeline

Ongoing

Key Alliances

- The Nature Conservancy—Maine Chapter
- U.S. Fish & Wildlife Service Gulf of Maine Coastal Program
- U.S. Geological Survey Patuxent Wildlife Research Center
- Cumberland County Soil and Water Conservation District
- Maine Coastal Program/ Department of Agriculture, Conservation and Forestry

Other Cooperators

- Land trusts
- Landowners
- Maine Department of Environmental Protection
- Municipalities
- National Oceanic and Atmospheric Administration

Description

Centuries of human impacts have compromised the ability of many coastal habitats to sustain functions critical to long-term ecosystem resilience. Where feasible and cost-effective, habitat restoration can counter these cumulative impacts and increase resilience.

Working with allied organizations, Casco Bay Estuary Partnership (CBEP) will continue providing strategic funding, technical assistance, grant writing, and project management to support habitat restoration and enhancement projects, particularly those focused on tidal wetlands and eelgrass beds. These targets align with the newly revised State Wildlife Action Plan, the Gulf of Maine Council's Habitat Restoration Program, and other regional priorities.

Habitat restoration and enhancement projects are complex, sometimes requiring years to develop from initial concept to completion. Habitat restoration targets will best be met by:

1. tracking long-term progress to achieving restoration goals;
2. developing a portfolio of restoration opportunities; and
3. working with communities, landowners and organizations to identify opportunities where barriers to completion can most readily be overcome.

Tidal Wetlands and Tidal Restrictions

Tidal wetlands, an important component of the nearshore environment, provide habitat for diverse species and have a long history of human use. Road crossings and dams along the shoreline have created many restrictions that limit or entirely block tidal flow, converting intertidal habitats into freshwater wetlands or impoundments. Where tidal wetlands remain, they are often degraded (*e.g.*, colonized by invasive species such as *Phragmites* or no longer suitable forage areas for wading birds).

CBEP has used high-resolution elevation data and aerial photography to catalog more than 70 locations where roads (primarily), railroads, dams, or other structures restrict the reach, range and flow of tides. Restoring tidal functioning in these settings by replacing undersized culverts and removing coastal dams or dikes can strengthen wetland resilience—increasing stream connectivity and sediment transport, restoring salt marsh habitat, and fostering the capacity of wetlands to adapt as sea levels rise.

CBEP has facilitated three tidal restoration projects to date and will continue monitoring these. In the future, CBEP will restore further sites as opportunities arise that align with emerging partnerships and with related local goals (such as water quality improvement or fish passage). In addition, CBEP may consider pursuing other collaborative approaches to tidal wetland restoration (*e.g.*, invasive plant control).

Eelgrass Beds

Coverage of eelgrass beds, which provide habitat for diverse species, declined 58 percent between 2001 and 2013, with localized losses close to 100 percent. CBEP expects to provide continued funding and in-kind staff support for a pilot eelgrass transplant study begun in 2015 by the U.S. Geological Survey Patuxent Wildlife Research Center. If that study identifies successful transplant methods, the next step will be to pilot eelgrass revegetation in one or more embayments (contingent on continued partner support and external funding).

Resources

Restoration projects require a significant up-front investment (*e.g.*, for staff time to identify prospective projects and build relationships with landowners and local officials, and up to $10,000 per project for technical analyses and preliminary designs) before funds can be raised to cover project implementation costs. Significant CBEP staff time will be allocated to project development, and core CBEP funds will be used to leverage funding for project implementation. Significant resources from key allies and from funders are needed to support this Action.

Outputs

- Feasibility studies, engineering designs, research plans, supplies and materials
- Site assessments, monitoring plans, monitoring data
- Grant proposals raising funds for implementation
- Permits, grant reports, landowner agreements
- Completed restoration projects

Outcomes

- Project implementation and monitoring
- Restoration of coastal habitat and watershed connectivity
- Improvements to Bay's habitats, water quality, ecosystem function and integrity

Metrics and Targets

Metric	*Target*
Number of assessments of potential restoration projects or project sites completed	3 by 2021
Number of coastal restoration projects implemented, on average	1 every two years

Coordinate Efforts to Restore Aquatic Habitat Connectivity

Goal 1: ***Protect, restore and enhance key habitats that sustain ecological health***

Strategy 1.2: ***Restore and enhance coastal habitats and habitat connectivity that are important to sustaining the health of Casco Bay***

Purpose

Implement projects that restore aquatic habitat connectivity in the Casco Bay watershed

Timeline

Ongoing

Key Alliances

- U.S. Fish & Wildlife Service Gulf of Maine Coastal Program
- Trout Unlimited
- Cumberland County Soil and Water Conservation District

Other Cooperators

- Land trusts
- Landowners
- Maine Department of Marine Resources
- Maine Department of Transportation
- The Nature Conservancy—Maine Chapter
- Municipalities
- National Oceanic and Atmospheric Administration
- Maine Coastal Program/ Department of Agriculture, Conservation and Forestry
- Maine Stream Connectivity Workgroup

Description

Recent research highlights the importance of annual pulses of out-migrating juvenile anadromous fishes (*e.g.*, alewives) as fodder for commercially and ecologically valuable groundfish. Restoring anadromous fish to rivers is important to reestablishing inshore populations of cod and other large predatory species. For decades, lack of these predatory fish in Casco Bay has diminished the local fisheries and reduced the Bay's health and resilience.

Well-managed projects designed to enhance diadromous fish passage can provide numerous other benefits by enhancing river continuity (the river processes and functions that enable transport of woody debris, sediment and water downstream; store floodwaters; and facilitate movement of aquatic and terrestrial organisms upstream and downstream). Projects that support these aquatic system functions further enhance the resilience of Casco Bay and its tributaries.

To help identify opportunities for increased aquatic habitat connectivity, Casco Bay Estuary Partnership (CBEP) worked with Trout Unlimited chapters and the U.S. Fish & Wildlife Service Gulf of Maine Coastal Program (USFWS GOMCP) to create a *Casco Bay Fish Passage Atlas*. The Atlas was incorporated into Maine's Stream Habitat Viewer, making the data widely available. CBEP will extend this work in the coming years through continued efforts to restore fish passage at dam and culvert sites.

Major Dams

Fish passage data confirm the impact of dams blocking riverine migration of diadromous fishes. In the Casco Bay watershed, dams block movement of anadromous fishes to entire watersheds and sub-watersheds, including hundreds of miles of streams and thousands of acres of lake habitat, sharply reducing their capacity to support coastal fisheries.

Dams diminish water quality as well. Much of the main stem of the Presumpscot River fails to meet water quality standards due largely to dams creating a series of reservoirs that are vulnerable to low oxygen conditions and can no longer support riverine fish and invertebrate communities.

CBEP will continue exploring ways to facilitate provision of effective fish passage at remaining dams on the Presumpscot, Royal and Stroudwater rivers. Ensuring fish passage at the Saccarappa and Mallison Falls dams is a priority as it would open up the entire Little River sub-watershed to anadromous fishes. Passage at the Gambo dam would allow migratory fishes access to the Pleasant River as well. Fish passage at two town-owned dams on the Royal River (located close to tidewater) would open up the watershed to diadromous fishes, and access to the Stroudwater River could be assured by passage at a small head-of-tide dam owned by the City of Portland.

Even the best fish passage facilities act as partial barriers to fish migration, and do little to reestablish other vital functions of river continuity. Dam removal is preferable for improving water quality and river health. In cases where dam removal appears to be a practical alternative, CBEP will provide technical and other assistance to help evaluate potential costs and benefits.

Culverts, Small Dams, and Other Barriers

USFWS GOMCP has twice analyzed Casco Bay fish passage data to produce lists of top fish passage restoration opportunities, sharing results that have helped catalyze fish passage improvement projects by Trout Unlimited, municipalities and others. Through its Stream Smart program, Maine Audubon offers trainings for landowners, contractors and other professionals on constructing road stream crossings that maintain fish and wildlife habitat while protecting roads and public safety. These efforts provide a robust infrastructure that CBEP can help maintain and expand, encouraging and supporting projects that improve stream continuity in smaller tributaries.

CBEP will work with these organizations and others to facilitate replacement of undersized road crossing structures, giving priority to coastal streams and waterways in the lower watershed that block movement of diadromous species to freshwater habitat and that pose flooding risks. Barriers at or near head of tide are of particular interest. (The Partnership may also assist municipalities or other organizations with high-value opportunities elsewhere in the watershed.)

Resources

Replacement of undersized or impassable culverts, provision of effective fish passage at dams, and dam removal are time-consuming and expensive efforts that typically require multiple organizations and external funding. Most regional fish passage improvement projects will advance under the leadership of other organizations, but significant CBEP staff time may be needed to facilitate project completion. As with restoration projects, upfront cash outlays (typically under $10,000) are often required to cover technical analyses or development of preliminary designs. Core CBEP funds will be used to leverage additional funds for project implementation.

Outputs

- Feasibility studies, engineering designs, site assessments
- Grant proposals raising funds for implementation
- Permits, grant reports, landowner agreements
- Completed projects

Outcomes

- Short-term
  - Project implementation and monitoring
- Medium-term
  - Restoration of watershed connectivity
- Long-term
  - Improvements to fish passage, river continuity, ecosystem function and aquatic system resilience

Metrics and Targets

Metric	*Target*
Number of studies or site assessments completed to support restoration	3 by 2021
Number of fish passage grant proposals for the watershed, annual average	1
Number of watershed connectivity projects implemented, annual average	1

Train Habitat Restoration Practitioners

Goal 1: ***Protect, restore and enhance key habitats that sustain ecological health***

Strategy 1.2: ***Restore and enhance coastal habitats and habitat connectivity that are important to sustaining the health of Casco Bay***

Purpose

Increase local capacity to implement habitat restoration and enhancement projects

Timeline

Begin in late 2016 or early 2017

Key Alliances

- U.S. Fish & Wildlife Service Gulf of Maine Coastal Program
- Wells National Estuarine Research Reserve

Other Cooperators

- National Oceanic and Atmospheric Administration Restoration Center
- The Nature Conservancy—Maine Chapter
- Maine Rivers
- Maine Coastal Program/ Department of Agriculture, Conservation and Forestry
- Maine Audubon Stream Smart Program

Description

Environmental restoration projects are complex efforts that often span years from initial concept to completion—requiring staffing to evaluate project opportunities, develop preliminary restoration goals, find funding for design and site evaluation, review restoration methods, write monitoring plans, develop engineering designs, supervise contractors and monitor completed projects. Few individuals or organizations in the Casco Bay region have sufficient experience or capacity to manage complex aquatic restoration projects, limiting the pace at which aquatic restoration can be completed.

The potential value of increased habitat restoration training can be judged by the success of Maine Audubon's Stream Smart program, which trains landowners, contractors and other professionals on constructing road stream crossings that maintain fish and wildlife habitat while protecting roads and public safety.

Casco Bay Estuary Partnership (CBEP) will complement that existing effort by working with other organizations in the region, such as the U.S. Fish & Wildlife Service Gulf of Maine Coastal Program, National Oceanic and Atmospheric Administration Restoration Center, and Wells National Estuarine Research Reserve to provide opportunities for regional professionals and volunteers to develop expertise and skills related to habitat restoration project management.

Resources

CBEP anticipates working with others to organize one regional training opportunity each year. CBEP funds would be matched by contributions from other sources, with total cash outlay under $5,000 annually. Limited CBEP staff time would be needed to coordinate trainings and provide administrative support. This Action would require other organizations to lead program delivery.

Outputs

Training events and workshops

Outcomes

- Short-term
  - Increased capacity for habitat restoration and enhancement projects
- Medium-term
  - Restoration of aquatic habitat; protection of coastal habitat; protection of wetlands, forests, floodplains, and other areas that contribute to water quality
- Long-term
  - Improvements to Bay's habitats, water quality, ecosystem function and integrity

Metrics and Targets

Metric	*Target*
Number of training events and workshops by 2020	3

Study Novel Methods to Enhance Ecosystem Functioning

Goal 1: ***Protect, restore and enhance key habitats that sustain ecological health***

Strategy 1.2: ***Restore and enhance coastal habitats and habitat connectivity that are important to sustaining the health of Casco Bay***

Purpose

Research innovative approaches being tested elsewhere to improve ecosystem health

Timeline

Begin collecting information in 2017, with outreach materials by 2018 (and demonstration project timing dependent on cooperating organizations)

Key Alliances

- Island Institute
- SEANET research consortium
- Maine Department of Marine Resources
- Maine Department of Environmental Protection
- Maine Coastal Program/ Department of Agriculture, Conservation and Forestry
- Maine Geological Survey

Other Cooperators

- Gulf of Maine Research Institute
- Friends of Casco Bay
- Coastal towns

Description

Many creative approaches to boost the health of coastal ecosystems are being used elsewhere, yet few of these are being explored in Maine. Given the dynamic change within coastal ecosystems, these methods—still largely untested within Maine—are likely to become an increasingly important management tool.

Casco Bay Estuary Partnership (CBEP) will help explore the feasibility in the Casco Bay region of using techniques such as:

- Artificial oyster reefs or mussel beds;
- Family "oyster gardening;"
- "Living shorelines" that reduce erosion threats while improving coastal habitat;
- Aquaculture of algae or shellfish to enhance water quality; and
- Active liming of tidal flats to mitigate the effects of coastal acidification.

Living shorelines, for example, typically incorporate living plants and animals as an integral part of a multi-layered shoreline defense (*e.g.*, construction of artificial oyster reefs or offshore bars to reduce wave energy, or planting of salt marsh vegetation along an eroding shore). In some cases, living shorelines are intended primarily to provide habitat or water quality benefits, offering a way to incorporate green infrastructure into developed shorelines.

Island Institute and SEANET research consortium scientists are already studying the potential for seaweed and shellfish aquaculture to lower nutrient concentrations, reduce excess phytoplankton numbers, and increase water clarity. Aquaculture could also provide economic benefits and diversify income sources in coastal communities dependent on marine resources.

CBEP will tap into national and regional networks to gather information on innovative approaches to share with members of the CBEP community. It will help others in the region explore use of these approaches to help address Casco Bay's long-term challenges. With practices that appear promising, CBEP will conduct outreach to shorefront landowners, consulting engineers and others.

Resources

Minimal CBEP staff time is needed to gather information and prepare initial outreach materials (factsheet, web content or presentations) for sharing findings regionally. Additional staff effort will be needed to coordinate with other organizations to test innovative technologies in Casco Bay. Limited funding (under $10,000) may be used to facilitate demonstration projects or to support data collection documenting project effectiveness. Involvement of other organizations will be essential to implement demonstration or test projects.

Outputs

- Outreach materials concerning regional potential for applications of innovative ecosystem technologies (including guidance on living shorelines)
- One or more projects testing suitable technologies

Outcomes

- Short-term
  - Increased local knowledge and understanding of relevant technologies and their potential application to Casco Bay
- Medium-term
  - Pilot-scale use of emerging technologies to support ecosystem function
- Long-term
  - Improvements to Bay's water quality, ecosystem function and integrity

Metrics and Targets

Metric	*Target*
Projects testing novel methods to enhance ecosystem functioning in Casco Bay completed by 2021	At least 2 by CBEP or allied organizations

Goal 2

Reduce nutrient pollution and its impacts, including coastal acidification

While nutrients like nitrogen and phosphorus are essential for plant growth, elevated levels in coastal waters can trigger a cascade of negative consequences—such as algal blooms, low dissolved oxygen and even fish kills. Excess nutrients also aggravate coastal acidification, which threatens shellfish and other marine organisms. Nutrient pollution poses a dominant long-term threat to Casco Bay's health—particularly in its inshore waters, and could increase the Bay's susceptibility to other stressors (*e.g.,* climate change and invasive species). Nutrient pollution is likely to increase in coming decades with population growth and changes in land use.

Nitrogen is often the nutrient of greatest concern for coastal waters. Compared with other coastal bays in the Northeast, Casco Bay waters have moderately high concentrations of nitrogen, which enters the Bay through urban and suburban runoff, wastewater treatment and Combined Sewer Overflows (CSOs), atmospheric deposition from smokestacks and tailpipes, and potentially from offshore waters.

Casco Bay Estuary Partnership (CBEP) seeks to improve scientific understanding of nutrient dynamics in Casco Bay, support funding for improved stormwater management, help municipalities adopt improved land use practices, and coordinate with allied organizations on nutrient and stormwater outreach.

Strategy 2.1: Fill the gaps in scientific understanding of Casco Bay's nutrient sources, processes and impacts that are needed to guide policy and management decisions

To effectively and efficiently address the threats that nutrient pollution poses for Casco Bay, CBEP needs to combine robust scientific understanding of nutrient processes with understanding of Bay dynamics. This approach will be iterative, with relatively simple preliminary models of nutrient processes in the Bay and watershed helping answer management questions and identify additional data collection and research needs.

Strategy 2.2: Encourage use of green infrastructure to reduce nutrient pollution from runoff

The volume of nutrients entering Casco Bay from land-based runoff could be greatly reduced by simple behavioral changes (*e.g.,* reduced use of lawn fertilizers) and by more widespread use of "green infrastructure" and "Low Impact Development" (LID) practices. Expanded use of these technologies is best advanced by a multi-pronged approach that combines place-based planning (see Action 4.2 A) with local implementation, outreach and education. To encourage broader adoption of innovative approaches to managing runoff, CBEP can promote localized information, presentations and training materials that highlight the practical, financial and ecological benefits.

Strategy 2.3: Advance policies and regulations that minimize nutrient pollution and coastal acidification

Federal and state regulatory policies and practices are key tools to protecting water quality and ecosystem health. CBEP can serve as a venue for considering costs and benefits of alternative policies and regulations, and can apply science to inform local understanding needed to evaluate decisions and policy alternatives.

Strategy 2.4: Seek long-term solutions for funding stormwater management and constructing stormwater infrastructure

Municipalities face significant long-term water costs, particularly with stormwater management, due to new regulatory requirements, aging infrastructure, and (in some cases) a historical pattern of under-investing in that infrastructure. In addition, the region must determine how to fund stormwater management in already developed landscapes, and how to sustain water quality as population expands and stressors increase. Creative solutions to financing water programs (*e.g.,* creation of a stormwater utility, a legal means of charging fees for stormwater management) could help communities cope with escalating costs.

Assess Casco Bay's Nutrient Sources, Cycles and Impacts

Goal 2: Reduce nutrient pollution and its impacts, including coastal acidification

Strategy 2.1: Fill the gaps in scientific understanding of Casco Bay's nutrient sources, processes and impacts that are needed to guide policy and management decisions

Purpose

Develop understanding of Casco Bay nutrient processes to better guide policy

Timeline

Begin development of loading estimates in 2016, with SEANET expecting to start model development in 2017 and complete by 2019

Key Alliances

- SEANET research consortium
- Maine Department of Environmental Protection
- U.S. Environmental Protection Agency

Other Cooperators

- Friends of Casco Bay
- Academic scientists
- National Oceanic and Atmospheric Administration
- Gulf of Maine Research Institute
- Maine Coastal Program/Department of Agriculture, Conservation and Forestry

Description

While the basic science of nutrient processes in coastal waters is well understood, how those processes play out in Casco Bay is less clear. More rigorous understanding of nutrient inputs and behavior within the Bay requires a concerted, multi-pronged effort, integrating scientific inquiry, model development, and data collection. Specifically, modeling tools are needed to assess watershed loading and to understand how nutrients cycle through the Bay's ecosystem.

Lessons learned from this Action will influence creation of a Casco Bay Monitoring Plan (Action 4.3.A), shape development of river and stream monitoring programs (Action 4.3.C), and clarify priorities for understanding water movement in Casco Bay (Action 2.1.B).

Model development and data collection are complementary efforts to understand Casco Bay. New data can strengthen models via improved boundary conditions, better calibration, and testing of model output. Models, in turn, can help identify key data gaps and prioritize data collection.

Despite years of monitoring, much of the data needed to develop robust models are sparse or out-of-date. For example, none of Casco Bay's major tributaries are currently monitored for river discharge, and limited data exist on nutrient (especially nitrogen) concentrations in Casco Bay's streams and rivers. Casco Bay Estuary Partnership (CBEP) will work to address these data gaps under several other *Plan* Actions (Actions 2.1.B, 4.3.A and 4.3.C).

Local and Bay-wide models can make efficient use of limited data by systematically combining it with understanding of coastal processes. To clarify which sources contribute nutrients

to Casco Bay, scientists with the SEANET research consortium plan to use modeling tools to assess watershed loading (as a first step toward creating an ecosystem model for Casco Bay). Spatially explicit estimates of nutrient loads can facilitate local studies of nutrient processes. They also provide data necessary to drive a dynamic model of the Bay's nutrient processes, which could in turn improve understanding of nutrient impacts (*e.g.,* fueling algal blooms, causing anoxia and exacerbating acidification).

SEANET also plans to deploy water quality monitoring buoys, pursue other Bay-related studies, and participate in the Casco Bay Monitoring Network (Action 4.3.A). CBEP will work closely with SEANET as it finalizes research plans, and will seek to ensure strong communication between scientists and stakeholders through the Casco Bay Nutrient Council (Action 2.3.A).

CBEP will also work with state and federal agencies as needed to ensure that coastal scientists and managers are aware of models being developed to address local management issues, and to assist (as capacity allows) with other research projects involving Bay nutrient processes and coastal acidification.

Resources

CBEP will use limited staff time to assist SEANET consortium researchers in developing Casco Bay nutrient models and in facilitating other relevant research efforts. Significant CBEP funds (more than $20,000) may be needed to accelerate development of high-quality nutrient-loading estimates.

Outputs

- Spatially explicit estimates of nutrient loading to Casco Bay
- Watershed-loading model
- Casco Bay nutrient process model

Outcomes

- Short-term
  - Identification of needed data collection and monitoring priorities
  - Increased understanding of nutrient loading to the Bay
- Medium-term
  - Greater understanding of the effects of nutrients and increased nutrient loads on Casco Bay ecosystem processes
- Long-term
  - Better insight into costs and benefits of policy alternatives for addressing water quality concerns in Casco Bay

Metrics and Targets

Metric	*Target*
Watershed-loading model for Casco Bay	Completed by 2018
Nutrient process model for Casco Bay	Completed by 2020

Improve Understanding of Water Movement within Casco Bay

Goal 2: Reduce nutrient pollution and its impacts, including coastal acidification

Strategy 2.1: Fill the gaps in scientific understanding of Casco Bay's nutrient sources, processes and impacts that are needed to guide policy and management decisions

Purpose

Improve understanding of water flow in Casco Bay and its effects on nutrient processes, larval movement and sediment transport

Timeline

Begin in 2017 and complete by 2019

Key Alliances

- U.S. Geological Survey
- University of Maine
- SEANET research consortium
- Maine Department of Marine Resources
- Maine Department of Environmental Protection

Other Cooperators

- Friends of Casco Bay
- Gulf of Maine Research Institute
- Island Institute
- Maine Coastal Program/Department of Agriculture, Conservation and Forestry
- Maine Geological Survey
- National Oceanic and Atmospheric Administration
- Southern Maine Community College
- University of Southern Maine

Description

In May 2011, Casco Bay Estuary Partnership (CBEP) hosted a workshop for coastal scientists and resource managers to identify key data collection and modeling actions that could enhance understanding of Casco Bay circulation patterns and improve coastal management. Workshop participants characterized the needs of resource managers, identified key data gaps limiting model accuracy, and helped determine model features that would address scientific and management needs.

Improved understanding of water movement can heighten understanding and lead to better coastal policy of Casco Bay and better coastal policy (see Action 2.1.A). The ability to assess the temporal cycle of nutrients within particular Casco Bay embayments, for example, could reveal how vulnerable Bay waters are to water quality problems. Understanding large-scale water movement patterns could reveal the transport dynamics of lobster and clam larvae.

Several models of Bay-wide circulation exist, and standard tools have been applied to model water movement on a smaller (*e.g.*, sub-embayment) scale. Yet accuracy of such models is limited, in part by inadequate data, especially inshore. Lack of data regarding key input variables such as bathymetry (topography of the Bay's floor), river discharge and wind velocity strictly limits the accuracy of available models.

CBEP will continue to work with scientists, as well as state and federal agencies, to improve understanding of Casco Bay circulation, and to

facilitate communication of study results to a broader audience (see Action 4.1.A). A key role for CBEP will be to foster new partnerships that facilitate collection of the data needed for model refinement.

This Action is closely tied to reinstating flow monitoring on one or more Casco Bay tributaries (Action 4.3.C) and to coordinating members of the Casco Bay Monitoring Network (Action 4.3.A) to encourage collection of data (like inshore wind velocities) that contribute to understanding Bay water movement. CBEP will also work with federal and state agencies to seek improved shallow-water bathymetry and intertidal topography.

Resources

The costs involved in updating models and addressing data gaps that limit accuracy of circulation models are well beyond CBEP's ability to fund directly. While CBEP funding could help jumpstart efforts, this Action relies on building funding coalitions and coordinating the efforts of multiple organizations (a CBEP role that will require moderate staff time but aligns with related Actions: 2.3.A, 4.1.A, 4.3.A and 4.3.C).

Outputs

Improved circulation models for Casco Bay and sub-embayments of Casco Bay

Outcomes

- Short-term
  - Fewer data gaps limiting understanding of water movement in Casco Bay
  - Better understanding among policy makers of Bay's water movement
- Medium-term
  - Improved scientific and technical understanding of water movement in Casco Bay
  - Greater understanding of how circulation patterns may affect transport of nutrients and other pollutants
- Long-term
  - Increased understanding of how the Bay's water flow affects nutrient processes, larval movement and sediment transport

Metrics and Targets

Metric	*Target*
Additional data collected that allow further refinement of Casco Bay circulation models	By 2018

Work Collaboratively to Reduce Nutrient Pollution within a Priority Watershed

Goal 2: ***Reduce nutrient pollution and its impacts, including coastal acidification***

Strategy 2.2: ***Encourage use of green infrastructure to reduce nutrient pollution from runoff***

Purpose

Work collaboratively to identify a priority watershed and implement a collective effort to reduce nutrient pollution, employ green infrastructure approaches, and raise public awareness so as to inspire behavioral change

Timeline

Begin early in 2016

Key Alliances

- Cumberland County Soil and Water Conservation District
- Maine Department of Environmental Protection
- Municipalities

Other Cooperators

- Cumberland County
- Friends of Casco Bay
- Interlocal Stormwater Working Group
- New England Environmental Finance Center
- U.S. Environmental Protection Agency
- Portland Watershed District
- Watershed groups
- Long Creek Watershed Management District
- Maine Water Environment Association
- Maine Department of Transportation

Description

Roughly a third of the total nutrients entering Casco Bay come from land-based runoff (whether urban runoff, septic tank leachate, or other sources). Valuable work is underway within many sub-watersheds of Casco Bay (such as the Capisic Brook, Trout Brook, Long Creek and Concord Gulley watersheds) to address stormwater runoff. Additional work is beginning in other urbanized watersheds (such as Barberry Creek and Red Brook). Coastal towns are continuing their ongoing work to address failing septic systems, which contribute nutrients to the Bay and release pathogens—potentially prompting clamflat closures.

Existing efforts to address stormwater runoff tend to be geographically dispersed, implemented by multiple entities to address separate and often local goals. While some projects employ green infrastructure, they lack a public outreach component that links them to local water bodies and Casco Bay. A shared outreach strategy is needed to publicize green infrastructure projects, reinforce their benefits, and promote the need for behavioral changes among watershed residents and businesses.

To successfully foster greater use of green infrastructure (which is only being slowly adopted within the region), a visible initiative is needed that links stormwater—and the benefits of green infrastructure—to the health of coastal waters that are a vital economic and recreational asset. Casco Bay Estuary Partnership (CBEP) will convene

colleagues to identify a priority watershed in which to promote green infrastructure (and other tools for reducing nutrient flow to the Bay) through new demonstration projects as well as Bay-focused outreach, signage, tours and media coverage. After identifying the watershed, the group will implement projects and shared outreach.

Resources

This Action builds on efforts already underway by numerous organizations, with support from CBEP on project coordination. Success of the initiative will depend on external fundraising and on leveraging municipal and other funds.

Outputs

- Selection of priority watershed
- Outreach plan and project priority list
- Outreach materials for priority watershed
- Green infrastructure demonstration projects

Outcomes

- Short-term
  - Sharing of strategies/messages among stakeholders
- Medium-term
  - Increased community awareness of green infrastructure to inspire behavior change
- Long-term
  - Improved coastal water quality due to decreases in stormwater runoff

Metrics and Targets

Metric	*Target*
Select priority watershed	2016
Develop implementation plan, including outreach plans and targeted projects	2017
Promote green infrastructure demonstration projects in the priority watershed	2 by 2021

Share Innovative Stormwater Solutions

Goal 2: Reduce nutrient pollution and its impacts, including coastal acidification

Strategy 2.2: Encourage use of green infrastructure to reduce nutrient pollution from runoff

Purpose

Showcase innovative and cost-effective stormwater solutions for local decision makers

Timeline

Begin developing outreach materials in 2016 and delivering programs in 2017

Key Alliances

- Interlocal Stormwater Working Group
- Cumberland County Soil and Water Conservation District
- New England Environmental Finance Center

Other Cooperators

- Municipalities with examples to share
- Long Creek Watershed Management District
- Nonpoint Education for Municipal Officials

Description

Casco Bay Estuary Partnership (CBEP) and allied organizations will communicate to community leaders and residents the benefits of innovative approaches to stormwater management by developing case studies and related materials for design professionals, contractors, and municipal decision makers. Materials that demonstrate the effectiveness and costs of innovative stormwater technologies will be shared with municipal audiences such as conservation commissions, planning boards and town councils through presentations, workshops and related print materials and web content. In addition to addressing MS4 (Municipal Separate Stormwater Sewer System) communities, this outreach will include those municipalities that do not have MS4 permit obligations.

Case studies will highlight policy choices and innovative solutions already undertaken in Maine and other cold-climate states that have generated significant savings and community benefits while addressing long-term budgetary concerns. These outreach materials will emphasize the multiple and long-term benefits of effective stormwater management—for water quality, long-term municipal costs, reduction in shellfish bed closures, and overall ecosystem health. Materials will include a compilation of existing green infrastructure projects within the region, prepared in coordination with the Interlocal Stormwater Working Group.

Resources

Other organizations will lead implementation of this Action, which is closely allied to work already underway by the Interlocal Stormwater Working Group (since outreach is a formal requirement under the MS4 permits). Moderate CBEP staff time will be needed to coordinate with other organizations, and to support development and distribution of outreach materials. This role aligns with Action 3.2.B, the creation of a municipal self-assessment tool and online resource library of model policies and ordinances.

Outputs

- Communications plan for community outreach about stormwater benefits
- Compilation of existing green infrastructure projects within Interlocal Stormwater Working Group communities
- Presentations, primarily to municipal audiences; related outreach documents

Outcomes

- Short-term
  - Partners develop strategies and materials for municipal stormwater outreach
- Medium-term
  - Communities demonstrate increased knowledge of benefits associated with stormwater management
- Long-term
  - Local decision makers adopt local ordinances and policies encouraging innovative stormwater solutions

Metrics and Targets

Metric	*Target*
Communication plan for benefits of stormwater management	2017
Case studies of stormwater successes developed for Casco Bay audiences	5 by 2021
Presentations to municipal or civic group within the 16 communities on Casco Bay	Average of 6 per year, beginning in 2017

Form a Stakeholder-Based Group to Study Impacts of Nutrients and Costs of Nutrient Management

Goal 2: Reduce nutrient pollution and its impacts, including coastal acidification

Strategy 2.3: Advance policies and regulations that minimize nutrient pollution and coastal acidification

Purpose

Provide a forum for developing a shared regional understanding of costs and benefits associated with different approaches to nutrient management

Timeline

Convene Council in 2016 and complete consensus report in 2018

Key Alliances

- Portland Water District
- Cumberland County Soil and Water Conservation District
- Maine Department of Environmental Protection
- Interlocal Stormwater Working Group

Other Cooperators

- Maine Water Environment Association
- Conservation Law Foundation
- City of Portland
- City of South Portland
- Friends of Casco Bay
- Long Creek Watershed Management District
- Other wastewater treatment plant operators
- Cumberland County
- Greater Portland Council of Governments

Description

Efforts to control nutrient loading to coastal waters are complex and often expensive. Experience nationwide has shown that communities are unlikely to make significant investments to reduce coastal nutrient inputs without trust in the scientific, technical, and financial information underlying control efforts. One effective way to build that trust is through a public process in which multiple stakeholders participate on an equal footing to construct a shared understanding of issues and solutions.

Casco Bay Estuary Partnership (CBEP) will convene and staff a high-level, regional "Casco Bay Nutrient Council" that brings together representatives of municipalities (including towns where septic tanks are common), wastewater treatment plants, environmental groups and businesses. It will collectively study the costs and potential benefits of different approaches to limiting nutrients entering the Bay, or reducing the harm that they cause. An independent entity is essential so that participants and the public can trust that the Council has no prior agenda and can collaboratively construct shared knowledge that reflects participants' diverse interests.

The initial role of the Council will be to identify key scientific and technical questions among stakeholders to help guide studies of nutrient processes in the Bay and watershed (Action 2.1.A). The Nutrient Council will also develop a consensus report on costs and

opportunities for nutrient reduction in the Casco Bay watershed. Following that, it will discuss questions pertaining to nutrient sources, sinks and effects, and will synthesize available information (including results on nutrient dynamics in Casco Bay), and prioritize approaches to limiting the impact of excess nutrients.

CBEP will help to organize meetings, bring in experts to brief Council members, provide facilitation as required, and draft summary reports of the Council's findings. CBEP will also help seek funding to commission studies needed to advance Council deliberations. Further, CBEP will link the work of the Council with efforts to improve understanding of nutrient processes in Casco Bay (Actions 2.1.A and 2.1.B), ensuring that scientific research efforts address stakeholder concerns.

Resources

This Action will require significant time invested by a CBEP staff member (potentially one quarter of a full-time position). Limited CBEP funding may be needed to cover meeting costs (*e.g.*, facilitation, meeting space, and food for <$1,500 per meeting) and publication of reports (<$5,000 per report). Additional funds may be needed to answer specific technical questions raised by the Council; CBEP will seek supplemental funding to address those needs.

Outputs

- Nutrient Council meetings
- Report on cost/benefits of nutrient management options

Outcomes

- Short-term
  - Shared understanding of information needs and approach to addressing knowledge gaps; cost-based information about alternatives
- Medium-term
  - Efficient use of limited funds to address nutrient inputs
- Long-term
  - Protect Bay's habitats, water quality, ecosystem function and integrity

Metrics and Targets

Metric	*Target*
Nutrient Council meetings per year	2
Report on nutrient management alternatives	Completed by end of 2018

Reduce Combined Sewer Overflow Discharges

Goal 2: Reduce nutrient pollution and its impacts, including coastal acidification

Strategy 2.3: Advance policies and regulations that minimize nutrient pollution and coastal acidification

Purpose

Support the efforts of regional communities to address the financial and technical challenges involved in reducing CSO discharges

Timeline

Ongoing

Key Alliances

- Portland Water District
- City of Portland
- City of South Portland
- Maine Department of Environmental Protection

Other Cooperators

- Town of Cape Elizabeth
- City of Westbrook

Description

Antiquated sewer systems with underground pipes that carry both sewage and runoff rainwater can lead to the direct discharge of untreated sewage into Casco Bay during heavy rains. Portland, South Portland and Cape Elizabeth still have combined sewers that discharge into Casco Bay, while Westbrook's combined sewers discharge into the Presumpscot River.

All these communities have worked hard to eliminate Combined Sewer Overflow (CSO) discharge points (or outfalls). The number of active CSO discharge points has dropped from 80 in 1990 to 43 in 2014. Discharges have declined markedly both in absolute volume (cut in half since 2000), and in annual discharge per inch of rainfall (cut by about a factor of three).

Despite decades of work, though, more than 440 million gallons of combined sewer effluent was discharged to Casco Bay waters in 2014 during 166 CSO discharge "events." Reduction of CSO discharges is a priority for Casco Bay Estuary Partnership (CBEP), but making progress requires continued leadership from CSO communities and regulatory agencies, often working in collaboration with Portland Water District, which by charter manages wastewater treatment plants and sanitary sewers.

Regulators require CSO remediation, but the costs—which are substantial—rest with our communities. The City of Portland, which accounts for more than 90 percent of CSO discharges in the region, anticipates spending close to $170 million during the Tier III phase of its CSO control program.

The need for prompt action on CSO control is becoming more acute as climate change prompts more extreme precipitation events in the region. Work to control runoff pollution in the face of more intense precipitation includes CSO abatement action, increased use of green infrastructure and low-impact development (Action 2.2.A), and innovative approaches to stormwater management (Action 2.2 B).

CBEP staff members will support communities and regulators in their efforts to find creative solutions to financial and technical challenges, and educate area residents about ongoing efforts to address CSOs.

Resources

This Action will be implemented primarily by communities, regulatory agencies and utilities, with CBEP playing a supporting role that requires limited staff time or funding.

Outputs

- CSO remediation projects
- CBEP staff continues to attend City of Portland Water Quality Stakeholder Meetings

Outcomes

- Short-term
  - Reduced volume of CSO discharges per inch of annual rainfall
  - Reduced numbers of active CSOs
- Medium-term
  - Localized improvements in water quality
- Long-term
  - Improved water quality in Casco Bay

Metrics and Targets

Metric	*Target*
Number of remaining active CSO discharge locations	Under 30 by 2021
Volume of CSO discharges per inch of annual rainfall	10% decline by 2021
Total volume of CSO discharges per inch of annual rainfall	Average 2010-2014 value not exceeded more than once from 2015 through 2020

Help Address Stormwater and Water Infrastructure Finance Challenges

Goal 2: Reduce nutrient pollution and its impacts, including coastal acidification

Strategy 2.4: Seek long-term solutions for funding stormwater management and constructing stormwater infrastructure

Purpose

Facilitate community-based solutions to the long-term fiscal challenges associated with managing stormwater and water infrastructure

Timeline

Ongoing

Key Alliances

- New England Environmental Finance Center
- Greater Portland Council of Governments
- Cumberland County

Other Cooperators

- Cumberland County Soil and Water Conservation District
- Interlocal Stormwater Working Group
- Maine Department of Environmental Protection
- Portland Water District
- Long Creek Watershed Management District
- City of Portland
- Maine Water Environment Association
- Maine Water Utilities Association

Description

In the coming five years, Casco Bay Estuary Partnership (CBEP) will support several existing efforts to help local communities address infrastructure financing.

One initiative involves a U.S. Environmental Protection Agency (US EPA) grant to the New England Environmental Finance Center (NE/EFC) that is helping to provide technical assistance on stormwater finance in communities by six National Estuary Programs, including CBEP. The NE/EFC will partner with experts from the University of Maryland's Environmental Finance Center on a comprehensive review of water programs and potential funding mechanisms in selected New England communities. For communities not yet ready to engage in this extended analysis, the NE/EFC plans to host a number of workshops on environmental finance topics, provide direct consultation with municipal officials, and offer self-assessment tools and other online content.

CBEP also plans to work directly with local communities to help them assess stormwater management costs and the potential justification for and risks associated with adopting a stormwater fee. Before establishing its stormwater service charge, for example, the City of Portland engaged an engineering consulting firm to study whether a stormwater utility was feasible.

Finally, CBEP will facilitate discussions about creating shared regional mechanisms to address stormwater costs, working with existing regional entities, including the Interlocal Stormwater Working Group, Greater Portland Council of Governments, and Cumberland County.

Resources

This project will be led primarily by other organizations, with staff time invested by the CBEP Director who serves as principal investigator on the US EPA grant to NE/EFC.

Outputs

- Delivery of technical assistance on stormwater and water infrastructure finance to communities
- Town-level assessment of feasibility of establishing stormwater fees
- Discussion of regional stormwater funding mechanisms

Outcomes

- Short-term
  - Increased local understanding of finance options for stormwater and water infrastructure
- Medium-term
  - Adoption of local or regional stormwater funding mechanisms
- Long-term
  - Stable long-term funding sources to address costs of stormwater management
  - Improved water quality in Casco Bay

Metrics and Targets

Metric	*Target*
Locally based stormwater cost assessments	3 by 2021
Stormwater finance workshops	4 by 2021

Monitor Implementation of Portland's Stormwater Service Charge

Goal 2: Reduce nutrient pollution and its impacts, including coastal acidification

Strategy 2.4: Seek long-term solutions for funding stormwater management and constructing stormwater infrastructure

Purpose

Strengthen Portland's stormwater service charge program, and share lessons learned with other communities that are considering establishing stormwater fees

Timeline

Ongoing

Key Alliances

City of Portland

Description

In 2016, the City of Portland launched the region's first stormwater utility, charging a stormwater service fee to help fund future stormwater and Combined Sewer Overflow (CSO) remediation projects. This approach appears to be more equitable than the previous joint funding formula drawn from the general fund and from sewer fees. Other communities are watching the rollout of the City's new program with interest.

While the City of Portland is principally responsible for this Action, Casco Bay Estuary Partnership (CBEP) staff members and others in the Partnership can support its efforts. As a non-regulatory, non-advocac y organization with an ongoing interest in the program, CBEP can provide objective but supportive reviews of program implementation.

CBEP will focus on three areas: (1) allocation of funds collected as part of the fee; (2) likely and actual water quality benefits of projects funded by stormwater fees; and (3) allocation of stormwater "credits." CBEP will participate in any public review or oversight mechanisms that may be created to address these or similar questions. Finally, working with others, CBEP will share lessons learned from the program with other municipalities.

Resources

Limited CBEP staff time will be required to continue participating in the City of Portland's quarterly water quality stakeholder meetings and to stay current on program implementation. Additional resources—either staff time or funding for hiring expert assistance—may be needed to review program details.

Outputs

Annual reviews of the costs and benefits of projects funded by the stormwater fee

Outcomes

- Short-term
  - More information available to public, program managers and local decision makers
- Medium-term
  - Efficient use of program funds
  - Increased understanding of stormwater fee mechanisms in other regional communities
  - Adoption of additional local or regional stormwater funding mechanisms
- Long-term
  - Improved water quality in Casco Bay

Metrics and Targets

Metric	*Target*
Annual reviews of costs and benefits of projects funded by Portland's stormwater fee	1 per year 2016–2021

Goal 3

Foster resilient communities and their connections to Casco Bay

The Casco Bay watershed faces some of Maine's more intense growth and development pressure, which threatens to diminish the region's natural beauty and abundance. Casco Bay is a major regional asset, yet its importance as an economic driver is undervalued. Casco Bay Estuary Partnership (CBEP) can play a significant role in the coming years through public outreach and collaborative initiatives that illuminate the region's ecological and economic interconnections, celebrate the Bay's multiple values, and help citizens and leaders prepare for climate disruptions.

Strategy 3.1: Strengthen appreciation for the cultural, ecological and economic values of Casco Bay

Watershed residents who appreciate the many assets that Casco Bay provides and enjoy a strong sense of place are more likely to adopt practices that benefit the Bay and undertake work on its behalf. Greater comprehension of the interconnections between ecological and economic health can build support for protecting the Bay's well-being. Taking a collaborative approach to public outreach that engages members of the business and creative communities, CBEP will shape a campaign that encourages people to reflect on how the Bay enhances their lives and what public actions are needed to sustain its values.

Strategy 3.2: Improve local policies and practices to better protect the Bay

Municipalities need assistance assembling and applying the best available science to develop, enact and enforce ordinances that foster healthy water quality and ecosystems in Casco Bay. CBEP will support municipalities by providing resources, models, inspiration, technical guidance and moral support. Through its newsletter, publications, website, and networks, CBEP is well-situated to showcase model projects—inspiring broader adoption of best practices.

Strategy 3.3: Help communities prepare for climate change impacts and resulting economic, cultural and ecological disruptions

Climate disruptions will further tax the capacities and resources of municipalities within the Casco Bay watershed. CBEP can provide information to help communities anticipate and prepare for change.

Highlight Casco Bay's Economic Importance

Goal 3: ***Foster resilient communities and their connections to Casco Bay***

Strategy 3.1: ***Strengthen appreciation for the cultural, ecological and economic values of Casco Bay***

Purpose

Communicate findings through creative channels on the economic values of Casco Bay (*e.g.*, from recreation, tourism, shipping, marine trades and marine harvests) and the economic savings associated with climate preparedness

Timeline

Begin in 2016 and develop outreach materials in 2017

Other Cooperators

- Island Institute
- Greater Portland Council of Governments
- Manomet Center for Conservation Sciences
- Center for Business and Economic Research, University of Southern Maine
- Muskie School of Public Service, University of Southern Maine
- Economists at other Maine colleges and universities
- Creative Portland
- Portland Regional Chamber of Commerce

Description

Economic information can be a powerful motivator for those making decisions that affect the Bay. Yet few individuals, business leaders or municipal representatives have a sense for how much Casco Bay contributes to the regional economy owing to minimal data being available on a regional scale. (National Oceanic and Atmospheric Administration creates county-level assessments of the marine economy, and Maine Department of Marine Resources offers statistics on marine harvests, but these are not adequate proxies for calculating the local significance of marine-related industries.)

Even fewer data are available for assessing the economic impacts that coastal changes may bring to the region—in terms of sea level rise (one past study has been done), marine ecosystem disruptions (such as ocean acidification, altered water quality, or effects of invasive marine species), and changing precipitation patterns.

Casco Bay Estuary Partnership (CBEP) will commission an assessment of the economic importance of Bay-related industries and of the potential costs that could result from declines in Bay health and inundation of critical habitat and infrastructure. This assessment will gather information on the market values, jobs, and wages associated with Bay-dependent industries. If resources permit, a further study may be completed that looks at the services (benefits to humans) provided by the Bay ecosystem.

Results of this assessment will be shared broadly through a collaborative outreach effort that engages the region's business and creative communities. Building on past charrettes organized by the Portland Society of Architecture and the U.S. Green Building Council's Maine Chapter, CBEP and others will host forums for the business community to share research findings in coordination with a team of business and arts representatives that collectively reviews study

results and collaboratively plans an outreach strategy.

Resources

CBEP will select a contractor with relevant expertise to conduct the economic analyses, the cost of which will depend on their scope and sophistication (ranging from $20,000 up to many times that). CBEP will have to invest minimal staff time to manage that contract, but moderate staff effort will be needed to create and conduct outreach.

Outputs

- Report on the economic significance of Casco Bay and economic threats to its productivity
- Outreach program broadly sharing report findings

Outcomes

- Short-term
  - Increased understanding of the scope and characteristics of the marine-dependent coastal economy of Casco Bay
- Medium-term
  - Broader understanding of the importance of Casco Bay to the well-being of Casco Bay communities
- Long-term
  - Community support for policies and decisions that protect and restore the Bay

Metrics and Targets

Metric	*Target*
Completion and distribution of report on economic significance and threats	By end of 2017
Presentations to groups of business owners, neighborhood associations and municipal finance representatives	per year 2018–2019

Expand and Publicize Volunteer Opportunities

Goal 3: ***Foster resilient communities and their connections to Casco Bay***

Strategy 3.1: ***Strengthen appreciation for the cultural, ecological and economic values of Casco Bay***

Purpose

Foster widespread citizen engagement and community service on Bay-related projects by helping catalog, publicize and expand volunteer programs

Timeline

Compile existing listings and baseline figures in 2016, and begin distributing listings and profiles in 2017

Key Alliances

- Volunteer water quality monitoring programs (*e.g.,* Presumpscot River Watch, Friends of Casco Bay, Maine's Volunteer River Monitoring Program, Maine's Volunteer Lake Monitoring Program)
- Land trust stewardship programs
- Watershed groups
- Other nonprofit organizations (such as Maine Island Trail Association, Maine Audubon and Rippleffect)
- University of Southern Maine, University of New England, Southern Maine Community College

Other Cooperators

- Municipalities
- Businesses
- AmeriCorps

Description

Many valuable marine-related education and citizen science programs exist in the Casco Bay region, but their base of support is confined primarily to a limited pool of nonprofit organization members. Currently there is no cohesive regional system to help expand the potential volunteer base of an engagement pyramid (tiered to allow many levels of commitment—from tracking of organizational activities, to one-time participation in an event on up to ongoing stewardship, monitoring or other responsibilities). Volunteers typically begin at the base (observing what others are doing) and work their way up to become progressively more engaged, contributing more time and providing greater leadership. Contact with the base level of volunteers occurs primarily through websites, social networks, e-mail and e-newsletters.

Casco Bay Estuary Partnership (CBEP) can play an important role expanding the number of individuals who are aware of and interested in Bay-related activities. By cataloging, profiling and publicizing volunteer opportunities, CBEP can boost support for existing projects and help locate the volunteers needed to take on new initiatives. To ensure that its efforts are effective, CBEP will establish baseline levels of current Bay-related volunteer activity and monitor growth in numbers over the coming five years.

Resources

Significant CBEP or other staff time (the program need not be housed at CBEP) will be needed to compile information on current volunteer programs, assess needs for increased volunteer service, and establish baseline figures for current participation. Consistent ongoing effort will be needed to routinely update listing information, share project and volunteer profiles, and highlight new opportunities as they arise.

Outputs

- Newsletter content, social media postings, website content
- Volunteer needs summary (including baseline figures of current activity)
- Creation of new volunteer programs designed to implement a targeted need

Outcomes

- Short-term
  - Broader public awareness about volunteer opportunities
  - Wider range of opportunities, attracting a larger pool of prospective volunteers
- Medium-term
  - Increased volunteerism on Bay-related activities
- Long-term
  - Widespread citizen engagement and stewardship on behalf of the Bay and watershed

Metrics and Targets

Metric	*Target*
Number of volunteer profiles and opportunity notices distributed annually	12 annually, starting in 2017
Number of volunteer opportunities publicized in annually updated summary	5% increase annually starting in 2017
Number of volunteer hours per year recorded by partner organizations	5% increase annually starting in 2017

Encourage Experiential Learning Programs to Engage Students With Casco Bay

Goal 3: Foster resilient communities and their connections to Casco Bay

Strategy 3.1: Strengthen appreciation for the cultural, ecological and economic values of Casco Bay

Purpose

Foster ties to Casco Bay among youth engaged in experiential or expeditionary learning programs

Timeline

Begin research in 2016 with initial projects in 2016-2017 academic year

Key Alliances

- University of Southern Maine
- Expeditionary learning institutions
- Cumberland County Soil and Water Conservation District
- Friends of Casco Bay
- Gulf of Maine Research Institute
- Portland Water District
- Marine researchers

Other Cooperators

- Gulf of Maine Marine Education Association
- Maine Environmental Education Association
- Wells National Estuarine Research Reserve
- Land trusts
- Municipalities, businesses, nongovernmental organizations

Description

Students actively engaged in Bay-related research and stewardship efforts can serve as important emissaries to the larger community and cultivate an environmental ethic that informs their future decision making. The Casco Bay region has a wealth of schools committed to expeditionary/experiential learning with a strong focus on science, technology, engineering and math (STEM)—including King Middle School, Casco Bay High School, Baxter Academy for Technology and Science, Waynflete School's and Chewonki's Sustainable Ocean Studies summer program, Coastal Studies for Girls, and Harpswell Coastal Academy—as well as University of Southern Maine (USM) Metropolitan University initiative. Programs run by the Cumberland County Soil and Water Conservation District, Portland Water District, Gulf of Maine Research Institute, Rippleffect and others provide additional experiential learning opportunities.

Casco Bay Estuary Partnership (CBEP) will encourage existing programs to engage in Bay-related study by helping match schools with Casco Bay projects that could benefit from student engagement. After surveying opportunities for marine-related projects and "expeditions," the Partnership (along with USM faculty and representatives of other interested organizations such as the Gulf of Maine Marine Education Association, Cumberland County Soil and Water Conservation District and Friends of Casco Bay) will meet with representatives of schools and other educational programs to review opportunities, learn more about student needs, and identify what further supports are necessary. CBEP also will help schools receive broader media coverage for Bay-focused educational projects and presentations.

Resources

Significant CBEP staff time will be needed initially to catalog existing opportunities for Bay-focused projects, reach out to schools and other organizations, and identify shared needs and interests. Modest financial support will help facilitate participation by schools (by covering transportation and materials costs associated with Bay-related projects). The ongoing staff commitment will depend on the number of Bay-focused units and expeditions that occur. If the level of school engagement grows substantially, external grant funding will be required.

Outputs

- Report on existing opportunities for Bay-related education projects
- Stronger relationships with regional experiential learning schools and organizations
- Events and media coverage that highlight youth engagement with, and stewardship of, Casco Bay

Outcomes

- Short-term
  - Stronger collaboration between marine science and education communities
  - Greater understanding among youth about Bay ecosystems and health
- Medium-term
  - Youth develop an ethic of Bay stewardship
  - Bay science and stewardship benefit from youth contributions
- Long-term
  - Stronger community support for actions that protect the Bay
  - Bay-focused learning fully assimilated into educational institutions of communities around Casco Bay

Metrics and Targets

Metric	*Target*
Number of classes participating annually in Bay-focused units or expeditions	1–2 in the 2016–2017 school year, increasing to 5–6 by 2020–2021
Number of Bay-focused experiential learning presentations or events geared toward a general audience	2–3 per year, beginning in 2017

Offer Small Grants for Community-based Projects

Goal 3: ***Foster resilient communities and their connections to Casco Bay***

Strategy 3.1: ***Strengthen appreciation for the cultural, ecological and economic values of Casco Bay***

Purpose

Support locally led activities that effectively strengthen community ties to Casco Bay, encouraging greater appreciation for its values and actions to improve its health

Timeline

Ongoing with annual grant cycle

Key Alliances

- Land trusts
- Nongovernmental and civic groups
- Municipalities
- Schools

Other Cooperators

- Businesses
- State agencies

Description

In addition to its Habitat Protection Fund (Action 1.1.A), Casco Bay Estuary Partnership (CBEP) has in the past offered small grants (less than $5,000) to support community-based environmental stewardship activities that enhance aquatic habitats. CBEP is now expanding the scope of this second grants program to encourage new partnerships and a broad array of innovative projects designed to engage communities with Casco Bay. Environmental restoration and habitat enhancement projects will still be eligible, but CBEP will consider support for school-based marine education projects, citizen science and stewardship initiatives, storytelling and art projects (such as further expansion of the Casco Bay Stories project that CBEP launched in 2014), and other activities that demonstrably build greater public appreciation for Casco Bay.

Grant applications will be accepted annually, typically in winter, so that proposal review can be completed in time to support spring and summer projects.

Resources

Minimal CBEP staff time will be required to develop the Request for Proposals, manage annual grants competitions, promote media coverage, and manage reporting requirements. Core CBEP funds allocated to this Action will vary between $5,000 and $10,000 annually, depending on other funding needs. CBEP will seek additional funding to expand this program.

Outputs

- Annual RFP and grant awards
- Projects completed

Outcomes

- Short-term
  - Local groups envision creative approaches to engaging people in environmental improvement projects
  - Local groups implement projects that encourage people to steward the Bay and watershed
  - Support for local efforts to address environmental and community needs
  - Media coverage of environmental stewardship projects
- Medium-term
  - Building of new relationships and partnerships; cultivation of new approaches to environmental stewardship
  - Support for local people and groups to better steward and advocate for the environment
- Long-term
  - Community support for projects, policies and decisions that protect and restore the Bay and watershed

Metrics and Targets

Metric	*Target*
Number of grants funded per year	1–3
Number of grant-related media stories generated per year	2–4

Provide Technical Assistance to Casco Bay Communities

Goal 3: ***Foster resilient communities and their connections to Casco Bay***

Strategy 3.2: ***Improve local policies and practices to better protect the Bay***

Purpose

Provide technical assistance on marine and coastal issues to coastal communities, fostering stronger information sharing with municipal staff and volunteers

Timeline

Begin by 2018

Key Alliances

Maine Sea Grant

Other Cooperators

Coastal municipalities and other coastal stakeholders

Description

Maine Sea Grant and University of Maine Cooperative Extension manage a coast-wide network of marine extension professionals who work in designated regions to provide assistance and training on marine science and policy issues of local concern (*e.g.*, coastal resilience, impacts of development on water quality, control of invasive species, and aquaculture). Historically, Casco Bay has not been served by a marine extension team member, despite its large population and economic and ecological significance. This marine extension role, or an equivalent position, is greatly needed.

Casco Bay Estuary Partnership (CBEP) will work with Maine's Marine Extension Team to provide marine extension services to communities on Casco Bay, increasing CBEP's capacity to respond to issues of local concern. Initially, the extension responsibilities could be part of a CBEP staff position, but would best be fulfilled—as additional funding is found—through a dedicated, full-time position.

Resources

Funding will come from a combination of core CBEP funds and other sources, raised in part with the assistance of Maine Sea Grant. Marine extension services would contribute directly to many Actions in the *Casco Bay Plan*.

Outputs

Coastal municipalities and other coastal stakeholders

Outcomes

- Short-term
  - Improved relationships with municipalities and greater awareness of CBEP
  - Better municipal access to information regarding local coastal concerns (including climate change and resilience)
- Medium-term
  - Improved local decision making
- Long-term
  - More resilient coastal communities
  - Improved health of Casco Bay

Metrics and Targets

Metric	*Target*
Number of towns provided with marine extension services	8 in 2017–2019, increasing to 16 by 2021

Create and Promote a Municipal Self-Assessment Tool to Encourage Adoption of Local Policies That Protect Casco Bay

Goal 3: ***Foster resilient communities and their connections to Casco Bay***

Strategy 3.2: ***Improve local policies and practices to better protect the Bay***

Purpose

Help municipalities identify and implement policies to improve local water quality and foster the vitality of Casco Bay

Timeline

Prepare draft matrix and model materials by early 2018

Key Alliances

- Local municipalities
- Greater Portland Council of Governments
- Maine Coastal Program/ Department of Agriculture, Conservation and Forestry

Other Cooperators

- University of Southern Maine/Muskie Institute for Public Service
- Manomet Center for Conservation Sciences

Description

Local policies in areas such as watershed planning, land use, stormwater management, road construction and maintenance, and shoreland zoning can profoundly affect local water quality. This Action will help municipalities evaluate and track their progress toward implementing Bay-friendly municipal policies and practices.

Municipal policies and comprehensive plans have been surveyed and catalogued, in efforts to assess their environmental impacts, through numerous past projects: the *Community Strategies to Improve the Bay* report co-produced by Casco Bay Estuary Partnership (CBEP) and Friends of Casco Bay in 2002; a Manomet Center for Conservation Sciences climate adaptation study in the upper watershed; a *Casco Bay Environmental Planning Assessment* by the Greater Portland Council of Governments; and data collected by University of Southern Maine researchers as part of the Sustainable Solutions Initiative. CBEP will gather information from prior studies and update it as needed to develop (1) a matrix of municipal actions that communities could use to gauge past progress and identify next steps; and (2) an online resource library (routinely updated) of model policies, ordinances and recommended protocols designed to improve water quality and foster climate resilience.

Municipal staff members and boards can use the self-assessment matrix to systematically review policies and practices affecting local waters and climate preparedness such as climate risk assessments; allocation of municipal funds to support land conservation and management of town-owned lands; enforcement of key rules and policies; zoning provisions (*e.g.*, setbacks, density, and limits set on industrial and commercial zones); ordinances (*e.g.*, limiting use of pesticides and fertilizers); sea level rise adaptation measures; and support for septic assessments and shoreline surveys.

To assist municipalities that identify opportunities for improved policies and practices, CBEP will provide the following: access to an online resource library of model measures; technical assistance (Action 3.2.A) and trainings related to stormwater management (Actions 2.2.B and 2.4.A); and support for climate preparedness (Action 3.3.A). In coordination with the Maine Coastal Program and other allied organizations, it may also offer a "Bay-wise Planners Field Academy," helping improve their understanding of land use impacts on Casco Bay.

CBEP staff members (and any contractor hired) will work collaboratively with a group of municipal and regional planning entities to identify the most effective structure for the self-assessment matrix and the model materials. CBEP plans to seek alliances with organizations like Greater Portland Council of Governments that are eligible for Maine Coastal Program's Coastal Community Grants.

Resources

Funds will be needed for CBEP to hire a contractor to conduct the initial review of local policies, draft the matrix of recommended policies and practices, and develop the online library of model measures. CBEP staff time will be needed thereafter to provide technical assistance (Action 3.2.A) and periodic trainings.

Outputs

- Compilation of local policies and practices that would benefit the Bay
- Review of current municipal policies
- Resource library of model policies and practices

Outcomes

- Short-term
  - Better understanding of current policies and their impacts on the Bay
- Medium-term
  - Adoption of local policies that strengthen Bay protection
- Long-term
  - Protection the water quality, habitats, and ecosystem integrity of Casco Bay, and strengthening of the climate resilience of communities along the Bay

Metrics and Targets

Metric	*Target*
Compilation of current municipal policies completed	2017
Preparation of draft municipal self-assessment	2018
Completion of resource library of model measures	2019

Help Portland Create a Solution for Dredged Material Disposal

Goal 3: Foster resilient communities and their connections to Casco Bay

Strategy 3.2: Improve local policies and practices to better protect the Bay

Purpose

Help Portland identify an environmentally responsible disposal solution for material dredged from private and public berthing areas

Timeline

Ongoing

Key Alliances

- City of Portland
- City of South Portland
- Portland Harbor Commission
- Waterfront Alliance
- Maine Department of Environmental Protection
- U.S. Army Corps of Engineers

Other Cooperators

- Waterfront business owners
- Maine Coastal Program/ Department of Agriculture, Conservation and Forestry

Description

An economically vibrant waterfront economy is an important asset of Casco Bay. Waterfront businesses depend on periodic dredging both of Portland Harbor's Federal Navigation Channel and of the waters adjoining private piers.

Dredging is expensive, particularly if the contaminants present in dredged materials trigger requirements for environmentally sound disposal. The potential toxicity of sediments by Portland's public and private piers is problematic because current owners are expected to cover the costs of testing and removing dredged material even though they bear little responsibility for the contaminants it contains (which are thought to derive primarily from industrial and commercial activities in the 1800s and early 1900s, sewer effluents and stormwater runoff).

To explore possible solutions, Portland recently established a "Non-Federal Dredge Working Group" that is identifying disposal options, and raising funds for the feasibility studies and engineering needed to establish a "Confined Aquatic Disposal" (CAD) facility for Portland Harbor.

Casco Bay Estuary Partnership (CBEP) will continue to participate in the Working Group, assisting with efforts to find an environmentally responsible and economically affordable approach to disposing of potentially toxic sediment excavated from Portland Harbor.

Resources

CBEP has only a minimal time investment in this process, as the principal responsibility lies with the cities of Portland and South Portland, the Portland Harbor Commission and local pier owners.

Outputs

CAD disposal facility for Casco Bay

Outcomes

- Short-term
  - Partnerships with public and private entities looking to achieve reduced toxic exposure to the environment from contaminated sediments
- Medium-term
  - Safe removal and disposal of potentially toxic materials dredged from Portland Harbor
  - Dredging of private berthing areas
  - Improved business opportunities for pier owners, facilitating long-term maintenance of piers that support traditional and emerging marine industries
- Long-term
  - A viable and economically vibrant waterfront economy
  - A waterfront community with the financial resources necessary to respond to rising seas

Metrics and Targets

Metric	*Target*
Completion of CAD disposal facility	By end of 2018, pending funding
401 water quality certificate issued	To be determined
401 water quality certificate completed	Before dredging begins

Foster Climate Preparedness among Local Decision Makers

Goal 3: ***Foster resilient communities and their connections to Casco Bay***

Strategy 3.3: ***Help communities prepare for climate change impacts and resulting economic, cultural and ecological disruptions***

Purpose

Help targeted audiences within regional municipalities become better equipped to manage climate disruptions

Timeline

Begin work with allied organizations in 2016, with annual trainings planned through 2021

Key Alliances

- New England Environmental Finance Center
- Maine Geological Survey
- Maine Coastal Program/Department of Agriculture, Conservation & Forestry
- Maine Department of Environmental Protection
- Greater Portland Council of Governments

Other Cooperators

- Maine Sea Grant/University of Maine Cooperative Extension
- University of Maine Climate Change Institute
- University of Southern Maine
- Businesses
- Portland Regional Chamber of Commerce
- Wells National Estuarine Research Reserve
- Maine Audubon
- National Oceanic and Atmospheric Administration Coastal Services Center
- Maine Department of Transportation

Description

The Casco Bay region is vulnerable to a wide range of climate disturbances, yet preparedness efforts to date have been minimal and scattered. Casco Bay Estuary Partnership (CBEP) will work to convene municipal and other community leaders from around the watershed for focused trainings that improve their capacity to strengthen climate resilience.

Based on needs expressed by municipal officials and adaptation specialists working in the region, CBEP plans to organize, co-host or co-sponsor a series of skill-building, no- or low-fee trainings over the next five years. These activities might include:

- Encourage completion of sea level rise vulnerability assessments (in conjunction with Maine Geological Survey) in Casco Bay communities that have not yet undertaken these studies;
- Train public works directors, engineers and utility staff members in how to interpret and apply Intensity-Duration-Frequency curves, which concisely capture information on magnitude of rainfall, to enhance preparedness for extreme precipitation;
- Introduce realtors to the National Flood Insurance Program and help them identify characteristics of flood-prone and resilient properties;
- Invite leaders of the New Hampshire Coastal Adaptation Workgroup, Great Bay National Estuarine Research Reserve (NERR) and Wells NERR to present on ways that municipalities and regions can take an integrated approach to

climate adaptation and mitigation that fosters sustainability across all sectors; and

- Collaborate with the New England Environmental Finance Center and University of Maryland's Environmental Finance Center to offer Casco Bay leaders "Environmental Finance Boot Camp" trainings that enhance both economic and climate resilience.

Resources

Minimal CBEP staff time will be required to coordinate the trainings. Costs of the trainings will depend on factors such as speaker location and fees; availability of donated space; and in-kind contributions by allied organizations. Grant funding or business sponsorships could be sought for the more expensive trainings.

CBEP will explore the possibility of helping to support an Island Institute Fellow charged with advancing local climate adaptation planning on one or two Casco Bay islands. This focused effort could serve as a model for other communities trying to take an integrated and effective approach to climate challenges that cross sectors.

Outputs

At least five training events and associated outreach and guidance materials

Outcomes

- Short-term
  - More than 100 individuals in the watershed will receive specialized training that they can share with colleagues to enhance community preparedness
- Medium-term
  - Municipalities increase their capacity for anticipatory climate adaptation
- Long-term
  - Municipalities minimize destructive climate impacts and associated costs through enhanced preparedness

Metrics and Targets

Metric	*Target*
Specialized trainings to strengthen community preparedness	5 trainings by 2021
Number of people participating in trainings	100 participants by 2021

Promote Climate Adaptation Best Practices That Incorporate Sound Climate Science

Goal 3: Foster resilient communities and their connections to Casco Bay

Strategy 3.3: Help communities prepare for climate change impacts and resulting economic, cultural and ecological disruptions

Purpose

Provide current, scientifically sound guidance on climate preparedness measures so that communities can readily and cost-effectively institute changes

Timeline

Circulate research findings in 2016 and conduct further outreach in subsequent years

Key Alliances

- Maine Geological Survey
- Maine Coastal Program/Department of Agriculture, Conservation and Forestry
- Greater Portland Council of Governments

Other Cooperators

- New England Environmental Finance Center
- Cumberland County Emergency Management Agency
- University of Maine Climate Change Institute
- Cumberland County Soil and Water Conservation District
- Maine Department of Transportation
- Professionals in the creative economy (photographers, advertising copywriters, graphic designers, videographers, etc.)

Description

Many of the climate stressors that will have a significant regional impact—like sea level rise and ocean acidification—are only beginning to manifest. To encourage communities to engage in anticipatory adaptation, Casco Bay Estuary Partnership (CBEP) plans to share recent research on climate impacts and to work collaboratively with allied organizations providing clear and consistent guidance on what actions communities can take.

This action builds on an Advisory Services report (prepared by the Urban Land Institute during a 2014 resiliency assessment of the Portland and South Portland waterfronts) that advocates for a credible data source on which communities can depend for planning. CBEP compiled a peer-reviewed summary in 2015, and will update and publicize it as needed so that planners have a reliable benchmark as conditions and scientific findings change.

Tasks to fulfill this action will be developed collaboratively with allied organizations, but could include:

- Publicize findings from CBEP's summary on climate stressors (*Climate Trends in the Casco Bay Region*) through diverse and creative channels to ensure that decision makers in many sectors (from public health and emergency management to marine trades and tourism) begin anticipating impacts of these stressors;
- Prepare a handout of resources on flooding, shoreline stabilization and actions for increased coastal resilience for municipalities to distribute to shorefront property owners;

- Create one or more interpretive panels on sea level rise and other climate change impacts at Buoy Park in Portland where CBEP has existing educational displays;
- Assemble case studies of small communities outside Maine that are successfully tackling climate adaptation in an integrated manner and share those (online and through presentations) with Casco Bay communities;
- Create and widely disseminate information on the benefits/cost savings of climate preparedness, and deliver those messages and resources efficiently through creative venues (Actions 3.1.A and 4.1.A); and
- Include current climate science data and climate preparedness measures in upcoming revisions to the *Cumberland County Hazard Mitigation Plan*.

Resources

Moderate CBEP staff time will be required during the initial focus in 2016 (with funding in part through the Environmental Protection Agency's Climate Ready Estuaries program). Subsequent efforts will be supported primarily via grant funding, or by implementing collaborative efforts with other organizations.

Outputs

Climate Trends in the Casco Bay Region and other publications produced and distributed in print and online

Outcomes

- Short-term
  - Local decision makers better understand climate impacts likely to shape the Casco Bay region in coming decades
- Medium-term
  - Local decision makers recognize the need for more accelerated and integrated approaches to climate adaptation
- Long-term
  - Municipalities minimize destructive climate impacts and associated costs through enhanced preparedness

Metrics and Targets

Metric	*Target*
Climate stressor research findings appear in at least 25 organizational newsletters, several traditional media outlets and on social media	Distribution to at least 10,000 e-news recipients by 2017

Goal 4

Mobilize collective knowledge and resources to support Casco Bay

The Casco Bay Estuary Partnership (CBEP) serves as a convener, helping regional entities launch and sustain collaborative Bay-related initiatives. The Partnership coordinates an active "community of practice," leveraging support and maximizing resources so that residents throughout the watershed can better address the complex and evolving challenges facing Casco Bay.

Strategy 4.1: Serve as an information hub on Casco Bay issues and initiatives

CBEP mobilizes scientific, political, financial and human resources to address the needs of Casco Bay and its watershed by gathering, organizing and systematically sharing information.

Strategy 4.2: Provide an organizational anchor for initiatives that benefit the Bay

CBEP has a long record of assisting groups and coalitions with organizing, project development and grant seeking. It will continue traditional, grant-focused efforts to fund work that supports its mission, and explore innovative funding mechanisms that align with CBEP priorities.

Strategy 4.3: Expand the scope and coordination of Bay-related environmental monitoring

Numerous groups monitor Casco Bay or its watershed (*e.g.*, tracking water quality, invasive species, freshwater systems, biota and ocean acidification impacts), but many efforts operate in isolation with little coordination. The region would benefit from having a venue for evaluating long-term monitoring needs and a consistent way to share data. Coordinating monitoring would foster data sharing, help identify key environmental indicators, and advance a regional sentinel monitoring network.

CBEP will lead development of a robust, collaborative regional monitoring program. The costs of a comprehensive Casco Bay monitoring program outstrip the resources available solely through core U.S. Environmental Protection Agency funding so monitoring must be a collective responsibility that rests on shared priorities.

Gather and Share Casco Bay Information

Goal 4: ***Mobilize collective knowledge and resources to support Casco Bay***

Strategy 4.1: ***Serve as an information hub on Casco Bay issues and initiatives***

Purpose

Strengthen the Casco Bay Estuary Partnership's role as a central hub for information about the Bay and its watershed, and expand public access to CBEP's archives of Bay-related publications, research and data

Timeline

Ongoing

Key Alliances

- State and federal agencies
- Municipalities
- Nongovernmental organizations
- Research community
- Businesses

Description

Casco Bay Estuary Partnership (CBEP) has provided trusted technical information on Casco Bay for decades and has enhanced informational exchanges in the region (particularly through its Management Committee), but numerous entities working on behalf of the Bay are not linked to CBEP's informational network. A more systematic approach to exchanging information is needed among all the organizations that hold, develop and use information about Casco Bay and the watershed.

CBEP will work with allied organizations to more broadly distribute Bay-related information (*e.g.*, new research publications, relevant upcoming conferences and events, volunteer opportunities, and related press) via CBEP's website and e-newsletter as well as other organizational publications and social media.

To strengthen its role as a regional information hub, CBEP will improve its internal systems for collecting, storing and sharing information. CBEP has an extensive paper library (primarily of older papers and reports dating back to CBEP's first decade, many of which are still relevant and provide important historical baselines) as well as a searchable online publications library. To improve access to both paper and electronic resources, CBEP will systematically (1) catalog publications, reports, and other information on Casco Bay and produce a current bibliography of Bay-related information; and (2) scan paper reports of historical interest or containing historically important data, making them available online (where copyright allows).

In addition, CBEP will expand its Casco Bay Stories website by inviting other organizations and individuals (*e.g.*, schools and arts organizations) to submit Casco Bay Stories for review and inclusion in this growing archive of place-based narratives that foster greater appreciation for the diversity of human connections to the Bay.

Resources

This effort will require a significant up-front investment of CBEP staff time (over a period of months), and ongoing staff effort to maintain this system over time and to more broadly share informational resources. CBEP may need to rely on the data management expertise of other organizations or contractors.

Outputs

- Standardized systems for collecting targeted Casco Bay information; providing ready access to stored information; and sharing it with allied organizations and their constituencies
- New outreach content disseminated through electronic and social media
- New "Casco Bay Stories" content
- Bibliography of Bay-related information
- Expanded online publications library

Outcomes

- Short-term
  - Expanded access to Bay-related data and reports
  - Readily accessible bibliography of CBEP-archived materials
- Medium-term
  - Archived information is incorporated into future Bay-related research and studies
  - Bay-related research increases
- Long-term
  - Improved research, management and decision-making due to the availability of better information

Metrics and Targets

Metric	*Target*
Paper reports scanned and added to digital archives	By end of 2016
Bibliography of archived reports and data available online	2017
Systems enhanced for sharing information externally	Completed in 2017

Report on the State of the Bay

Goal 4: ***Mobilize collective knowledge and resources to support Casco Bay***

Strategy 4.1: ***Serve as an information hub on Casco Bay issues and initiatives***

Purpose

Provide regular updates on indicators of Casco Bay health and encourage public discussion of Bay science and management at periodic State of the Bay conferences

Timeline

Begin standardizing indicator preparation by 2017, with conference and report in 2020

Key Alliances

- Friends of Casco Bay
- Maine Department of Environmental Protection
- Maine Department of Marine Resources
- U.S. Fish & Wildlife Service Gulf of Maine Coastal Program

Other Cooperators

- Organizations that provide access to data
- Individuals who peer-review indicators
- Academic scientists

Description

The U.S. Environmental Protection Agency requires that each National Estuary Program provide periodic public reports (often based on a group of environmental indicators) summarizing conditions in its coastal waters. Casco Bay Estuary Partnership (CBEP) issues a *State of the Bay* report every five years in conjunction with a conference that fosters sharing of Bay-related information and ideas.

Most State of the Bay indicators are based on data collected by other organizations (especially state and federal agencies and Friends of Casco Bay), with CBEP's own role in data collection limited. This minimizes CBEP's monitoring costs but can complicate report preparation due to changes in data availability or content over time.

Before the next *State of the Bay* report in 2020, CBEP will work with monitoring partners to formalize a State of the Bay framework (as part of creating the new Casco Bay Monitoring Plan—Action 4.3.A). CBEP and monitoring partners will define data sources, craft data access agreements, and determine data analysis procedures for selected environmental indicators (automating data access and analysis wherever possible). In addition to streamlining *State of the Bay* report preparation, standardization will improve public access to data and results, and facilitate more frequent evaluation of the Bay's condition.

Resources

The *State of the Bay* report requires a substantial time commitment from CBEP staff during the year preceding the conference when the report is being completed. It also requires support from other organizations that provide access to data and review of draft results. Funding needs for the report and conference are major (approximately $40,000, or higher if contractual assistance is used), but could be reduced by improved coordination of data collection and management (Action 4.3.A).

Outputs

- Streamlined data analysis for select State of the Bay Indicators
- State of the Bay conference
- *State of the Bay* report

Outcomes

- Short-term
  - Greater consistency in reporting and more frequent updates of select State of the Bay indicators
  - Increased public understanding of Bay status and trends
- Medium-term
  - Stronger collaborations around data monitoring and analysis
- Long-term
  - Improved science and decision making pertaining to the Bay and watershed

Metrics and Targets

Metric	*Target*
Suitable data submitted to CBEP	Annually
Number of State of the Bay indicators formalized	At least 6 by 2019
State of the Bay report completed	2020
State of the Bay conference held	2020

Share Scientific and Community Information to Inform Relevant Policy Decisions

Goal 4: ***Mobilize collective knowledge and resources to support Casco Bay***

Strategy 4.1: ***Serve as an information hub on Casco Bay issues and initiatives***

Purpose

Inform development of effective policies to protect the Bay

Timeline

As need arises

Other Cooperators

- State and federal agencies
- Municipalities

Description

Casco Bay Estuary Partnership (CBEP) strives to be a trusted source of credible data and information on Casco Bay and its watershed. The *Casco Bay Plan 2016–2021* affirms and extends its commitment to scientific rigor, and to finding solutions to the Bay's environmental challenges. CBEP is neither a regulator nor a regulated entity but works constructively with both groups. CBEP has long-standing relationships with federal and state agencies, local governments and a wide range of nonprofit organizations. These connections enable CBEP to serve as a valued informational conduit for decision makers at local, federal, and state levels, informing policy decisions without being perceived as having a direct stake in the outcome.

Given the technical and practical expertise of CBEP staff, the network of contacts the Partnership embodies, and the complexity of challenges facing the Bay, CBEP and allied organizations will share information and insights with decision-makers at all levels. This input could be provided in varied settings from informal pre-rulemaking discussions or stakeholder working groups to formal rulemaking or permitting processes.

Resources

CBEP staff members already stay current on emerging policy changes so only limited additional time is needed to review and comment on proposed rules and ordinances.

Outputs

Submitted comments and testimony on proposed rules

Outcomes

- Short-term
  - Improved topical knowledge among policy makers
  - Higher visibility for CBEP among key policy makers
- Medium-term
  - Improved local, state and federal rules and policies
- Long-term
  - Improved water quality due to sounder management of coastal waters

Metrics and Targets

Metric	*Target*
Written comments submitted, or testimony delivered	At least 3 by 2021
Participation in informal policy discussions or working groups	At least twice by 2021

Lead Place-Based Planning to Benefit Habitat and Water Quality

Goal 4: Mobilize collective knowledge and resources to support Casco Bay

Strategy 4.2: Provide an organizational anchor for initiatives that benefit the Bay

Purpose

Lead, facilitate and support collaborative planning that benefits Casco Bay within sub-regions of the watershed

Timeline

Ongoing

Key Alliances

- Cumberland County Soil and Water Conservation District
- Maine Department of Environmental Protection
- Long Creek Watershed Management District
- New Meadows Watershed Partnership
- Presumpscot River Watershed Coalition

Other Cooperators

- Royal River Coalition
- Land trusts
- Municipalities

Description

Watershed-focused and place-based collaborations can help build support among local groups and local government in support of larger (Casco Bay watershed-scale) priorities. Casco Bay Estuary Partnership (CBEP) has consistently supported the work of existing sub-watershed and sub-regional scale collaborations, and helped catalyze the formation of new ones. CBEP is currently involved with four place-based efforts around the Presumpscot River, New Meadows watershed, Long Creek, and Crooked River. A fifth, centered on the Royal River, is in the early stages of development.

Smaller-scale efforts often benefit from the direct, personal connections that local people and organizations have with their immediate waters and landscapes. The most successful of these locally driven initiatives work collaboratively to implement specific projects and facilitate communication about shared issues and needs. Watershed groups can be particularly effective at illustrating linkages between local issues and the Bay by engaging communities at a local scale that is meaningful and recognizable.

Local collaborations usually operate based on a set of shared goals or priorities in the form of a plan. Informal place-based plans are complemented by formal watershed-based plans, which are often developed in response to regulatory imperatives or to facilitate access to federal nonpoint source water pollution program funding known as “Section 319” grants. CBEP has worked closely with Cumberland County Soil and Water Conservation District, the Maine Department of Environmental Protection, and the Cities of Portland and South Portland (among others) to develop and implement such plans.

CBEP will continue supporting the development, refinement and implementation of collaborative, place-based (*e.g.,* watershed, embayment or island) plans that sustain regional efforts, particularly those that incorporate habitat protection and restoration, water quality and community aspirations.

Resources

CBEP leadership in this arena requires significant staff time as plan development can be an extended, labor-intensive process. Some CBEP funding can help facilitate planning or implementation, but staffing place-based coalitions typically requires other organizations to dedicate significant staff time and seek external funding (or both).

Outputs

- Formation of place-based collaborations with shared goals and priorities
- Regional land conservation plans that reflect shared goals and priorities
- Formal watershed-based plans

Outcomes

- Short-term
  - Increased local capacity to work strategically and collaboratively to protect habitat, improve water quality, and achieve other community goals
  - Local project successes that can scale up and be shared across the larger watershed
- Medium-term
  - Implementation of goals, strategies and actions that benefit the Bay and watershed
  - Improved information exchange and emergence of new partnerships
- Long-term
  - Improvements to Casco Bay's habitats, water quality, ecosystem function and integrity

Metrics and Targets

Metric	*Target*
Implementation projects completed	1 per group per year
Collaborative events & meetings	2 per group per year
Development of new plan(s); refinement of existing plans	At least 1 by 2021

Host Technical Working Groups on Emerging Issues

Goal 4: ***Mobilize collective knowledge and resources to support Casco Bay***

Strategy 4.2: ***Provide an organizational anchor for initiatives that benefit the Bay***

Purpose

Foster formation of *ad hoc* working groups around emerging issues or shared interests to encourage collaborative approaches that benefit the Bay and watershed

Timeline

As need arises

Key Alliances

- Researchers
- State and federal natural resource agencies
- Nongovernmental organizations

Description

Working groups are short-term, *ad hoc* groups that form around shared interests or emerging issues. Casco Bay Estuary Partnership (CBEP) often plays a strategic role helping to convene working groups. Past examples include a circulation modeling workshop, the Casco Bay "Mud Summit," a workshop on green crab science, and groups working on eelgrass monitoring and restoration.

CBEP will continue hosting or supporting *ad hoc* working groups of scientists and other experts to discuss and address emerging issues in Casco Bay.

Resources

Generally, working groups require moderate amounts of staff time over a period of a few weeks or months, followed by lower levels of staff time to maintain progress. Total staff time needs will depend on the number of active working groups. In recent years, CBEP has managed one such working group a year, and that level of commitment is likely to continue.

Outputs

- New forums for collaboration between researchers and organizational representatives
- Project deliverables, such as reports or data

Outcomes

- Short-term
  - Increased frequency and scale of collaboration on topics of shared interest
  - Greater efficiency and more comprehensive information and results
- Medium-term
  - Expanded, scientific knowledge base of Casco Bay and its watershed
- Long-term
  - Improved decision making on Bay-related activities and policies

Metrics and Targets

Metric	*Target*
Number of working groups	1 per year
Number of working group meetings	2 per year
Number of deliverables (reports; data sets, new projects)	1 per group

Seek Resources to Support Programs That Benefit the Bay

Goal 4: Mobilize collective knowledge and resources to support Casco Bay

Strategy 4.2: Provide an organizational anchor for initiatives that benefit the Bay

Purpose

Build organizational capacity to implement the *Casco Bay Plan* by increasing and diversifying funding sources

Timeline

Ongoing

Key Alliances

- Management Committee members
- Watershed groups
- U.S. Fish & Wildlife Service Gulf of Maine Coastal Program
- Greater Portland Council of Governments

Other Cooperators

- University of Southern Maine Research Service Center

Description

The U.S. Environmental Protection Agency encourages National Estuary Programs to diversify and increase programmatic and leveraged funding by applying for grants from a variety of sources, including federal programs, state programs and foundations. Casco Bay Estuary Partnership (CBEP) has a long record of fundraising to support shared priorities. Recent successes include raising funds for Youth Conservation Corps work on Trout Brook; ocean acidification monitoring programs; the three-year Presumpscot River Vision, Values, and Priorities project; salt marsh restoration in Harpswell; and the Presumpscot Targeted Watershed Grant.

CBEP core staff members also support other groups working on behalf of the Bay, ranging from local organizations to academic researchers, in their efforts to seek funds for specific projects. CBEP involvement may be significant (*e.g.*, acting as fiscal agent) or minimal (*e.g.*, a letter of support to accompany a grant proposal).

In seeking alternative sources of funding to support implementation of the *Casco Bay Plan*, CBEP will (1) collaborate with allied organizations to identify opportunities for obtaining and diversifying revenue sources; (2) leverage local networks to attract federal funds (by identifying local sources of match); and (3) pursue external funding resources to support *Plan* Actions.

Resources

Significant CBEP staff time will be required to increase fundraising efforts and explore innovative sources of funding (which might yield little short-term success, but could potentially offer significant long-term benefits). CBEP also will seek *pro bono* professional assistance.

Outputs

- Updated list of grant-funding programs
- Pledged non-federal match (cash and in-kind)
- Completed and submitted grant proposals

Outcomes

- Short-term
  - CBEP and others are better able to take advantage of suitable grant programs
  - More numerous and competitive federal grant proposals submitted
- Medium-term
  - Increased local capacity for implementation; increased federal grant funding outside Section 320 U.S. Environmental Protection Agency funding
- Long-term
  - Improvements to Bay's habitats, water quality, ecosystem function and integrity

Metrics and Targets

Metric	*Target*
List of grant opportunities created in 2016 and updated annually	Annual updates
Number of collaborative external grant proposals per CBEP FTE	≥ 2 per year

Coordinate a Casco Bay Monitoring Network and Plan

Goal 4: Mobilize collective knowledge and resources to support Casco Bay

Strategy 4.3: Expand the scope and coordination of Bay-related environmental monitoring

Purpose

Convene and lead a Casco Bay Monitoring Network that identifies shared priorities and facilitates the efficient exchange of data, and foster development of a shared Casco Bay Monitoring Plan

Timeline

Begin early in 2016 and ongoing thereafter

Key Alliances

- Friends of Casco Bay
- University of Southern Maine
- Island Institute
- Bowdoin College Coastal Studies Center
- Gulf of Maine Research Institute
- Southern Maine Community College
- University of New Hampshire
- SEANET research consortium
- Maine Department of Environmental Protection

Other Cooperators

- Integral Sentinel Monitoring Network
- Northeastern Regional Association of Coastal and Ocean Observing Systems
- Northeast Coastal Station Alliance

Description

A growing number of entities are monitoring the waters within Casco Bay and its watershed (including Friends of Casco Bay, Maine Healthy Beaches Program, Maine Department of Marine Resources, the SEANET research consortium and the Gulf of Maine Research Institute, along with numerous academic researchers). Simultaneously, discussions are underway in the Northeast about the need to establish an Integrated Sentinel Monitoring Network able to document long-term change in coastal ecosystems.

The widespread interest in monitoring could help document changes underway in Casco Bay, but to date there has been little work to coordinate these efforts. Casco Bay Estuary Partnership (CBEP) will establish and staff a Casco Bay Monitoring Network in order to:

1. Catalog existing and anticipated monitoring programs;
2. Identify shared monitoring priorities;
3. Consider shared deployment of monitoring resources so that efforts led by different organizations complement and support each other;
4. Minimize duplication of effort or collection of similar but incompatible data; and
5. Facilitate sharing of data.

CBEP will also work with statewide and regional monitoring collaborations to place Casco Bay monitoring efforts into a larger context, share monitoring approaches, and link into shared data-access tools. Working with members of the Casco Bay Monitoring Network, CBEP will develop and periodically update a shared Casco Bay Monitoring Plan.

Resources

The costs of a comprehensive Casco Bay monitoring program far exceed the resources available through CBEP's core funding. Monitoring must be a shared responsibility of the many individuals and organizations with a stake in understanding the Bay. CBEP will invest moderate time in staffing the Network and helping to prepare the shared monitoring plan.

Outputs

- Casco Bay Monitoring Plan
- Revised data agreements

Outcomes

- Short-term
  - Improved communication among entities monitoring Casco Bay
- Medium-term
  - Greater efficacy of monitoring work and increased sharing of Bay-related monitoring data
- Long-term
  - Better early detection of changes in Bay water quality and habitats

Metrics and Targets

Metric	*Target*
Number of participants in Casco Bay Monitoring Network	Minimum of 8 organizations
Number of meetings of the Network	≥ 2 per year

Facilitate Improved Research on Changes in Casco Bay

Goal 4: ***Mobilize collective knowledge and resources to support Casco Bay***

Strategy 4.3: ***Expand the scope and coordination of Bay-related environmental monitoring***

Purpose

Foster and share scientific research that helps to explain how and why Casco Bay is undergoing rapid change and what communities in the region can do to cope with that change

Timeline

Begin Network discussions early in 2016 to determine site development timeline

Key Alliances

- U.S. Fish & Wildlife Service Gulf of Maine Coastal Program
- Wells National Estuarine Research Reserve
- Maine Department of Environmental Protection
- Maine Coastal Program/ Department of Agriculture, Conservation and Forestry

Other Cooperators

- Academic institutions
- Northeast Regional Association of Coastal and Ocean Observing Systems
- Northeast Coastal Station Alliance
- Integrated Sentinel Monitoring Network

Description

A bewildering array of forces are rapidly transforming the ecosystems and shorelines of Casco Bay, including sea level rise, warming air and water temperatures, ocean acidification, coastal development, and an influx of non-native species (some of which are becoming invasive). Responding constructively to these changes requires careful monitoring to detect changes (Action 4.3.A) and greater scientific understanding of where the changes may lead.

There is strong regional interest in establishing high-resolution, long-term monitoring locations where a broad range of environmental parameters can be monitored simultaneously. The goal of these "sentinel sites" is to document changing conditions and to collect information about the processes driving ecosystem change. The Northeastern Regional Association of Coastal and Ocean Observing Systems (NERACOOS) and the Northeast Regional Ocean Council are leading a discussion about sentinel monitoring, assembling information on existing sentinel monitoring programs, and developing design recommendations.

Casco Bay Estuary Partnership (CBEP) will establish a sentinel monitoring program for Casco Bay, and integrate data collection both with other Casco Bay monitoring efforts (Action 4.3.A) and with the regional sentinel monitoring network.

CBEP also plans to begin tracking stands of invasive *Phragmites australis* around Casco Bay (with a baseline established by 2017 and subsequent updates done at least every five years). This baseline will help in understanding whether *Phragmites* is expanding or not within the region.

CBEP will also work with academic institutions and other organizations to facilitate research that advances scientific understanding Bay changes (*e.g.*, studies of non-native and invasive species, means of controlling invaders like the European green crab, and methods to ameliorate ocean acidification).

CBEP will continue working with other organizations to assess the impacts of climate change and sea level rise on Casco Bay's tidal wetlands through such actions as: investigating sediment processes within narrow-valley wetlands and fringing marshes; monitoring relative sea-level rise (RSLR) at representative sites through the use of Sediment Elevation Tables (SETs) and other methods; and assessing how the elevation profile of Casco Bay's tidal marshes may affect how they respond to changing sea levels. Findings from these investigations will inform future tidal wetland protection and restoration work, as well as associated policies.

Resources

This Action will require significant CBEP staff time, depending on how much responsibility other organizations assume for sentinel monitoring. Initial set-up costs for a sentinel monitoring program could be substantial, and the budgetary commitment extends over time because data collection must continue long term.

Outputs

- Sentinel monitoring sites established
- SETs placed in Casco Bay wetlands and other data informing RSLR
- Sediment budgets and assessment of elevation profiles for representative marsh sites
- Baseline maps of invasive *Phragmites* stands around Casco Bay

Outcomes

- Short-term
  - Infrastructure in place to track changes in Bay ecosystems
- Medium-term
  - Ongoing documentation of changing conditions in the Bay
  - Improved understanding of changing coastal ecosystems
- Long-term
  - Better decisions regarding coastal management
  - Better water quality and ecosystem resilience

Metrics and Targets

Metric	*Target*
Establishment of sentinel monitoring sites	3 sites by 2020
SETs placed in Casco Bay tidal wetlands	Placed at a minimum of 5 sites by 2020
Baseline map of *Phragmites australis* stands around Casco Bay	By 2017

Expand Monitoring of Casco Bay Tributaries

Goal 4: Mobilize collective knowledge and resources to support Casco Bay

Strategy 4.3: Expand the scope and coordination of Bay-related environmental monitoring

Purpose

Increase understanding of conditions in rivers and streams that may influence the health of Casco Bay

Timeline

Begin in 2016 and gradually increase effort

Key Alliances

- Cumberland County Soil and Water Conservation District
- Maine Department of Environmental Protection
- U.S. Geological Survey
- Long Creek Watershed Management District
- Presumpscot River Watch
- Maine Volunteer River Monitoring Program
- Maine Volunteer Lake Monitoring Program

Other Cooperators

- University of Southern Maine
- U.S. Fish & Wildlife Service Gulf of Maine Coastal Program
- Municipalities
- Watershed groups

Description

The watershed's rivers and streams act as funnels, carrying not only water but stormwater runoff, nutrients, pesticides, road salt, fecal waste, eroded sediment, litter and other contaminants directly into Casco Bay. There are some data on the water quality of the Bay's major tributaries (thanks to the work of the Maine Department of Environmental Protection, U.S. Environmental Protection Agency, Presumpscot River Watch, U.S. Fish & Wildlife Service, and others), but limited capacity—historically and currently—has restricted the monitoring effort.

To better inform understanding of how tributaries influence the Bay, monitoring efforts need to be expanded both geographically and temporally. In addition, at least one river gauge on a major tributary needs to be installed to update baseline knowledge about the volume of water flowing out of the watershed.

Casco Bay Estuary Partnership (CBEP) will work with others to establish a regional framework for coordinated monitoring of rivers and streams, and advocate for re-establishment of river gauges on one or more of Casco Bay's major tributaries.

Resources

Expansion of freshwater monitoring will require a concerted effort over several years. While this effort might be led by CBEP staff, other organizations already involved with monitoring could also lead this effort. Some grant writing will be necessary to develop funding capacity to support watershed monitoring.

Outputs

- Establishment of a watershed monitoring committee
- A regional framework for monitoring in the Casco Bay watershed
- Establishment of at least one river gauge station
- Water quality data
- Grant proposals

Outcomes

- Short-term
  - Coordination among allied organizations
  - Strategic allocation of staff and funding resources toward expanded monitoring
  - Grant funding
  - Data on water quality and water quantity
- Medium-term/Long-term
  - Better understanding of the water quality and quantity of Bay's tributaries
  - Better understanding of the impact of tributaries on Bay's health
  - Better decision making
  - Improvements to the Bay's habitats, water quality, ecosystem function and ecosystem integrity

Metrics and Targets

Metric	*Target*
Creation of regional monitoring framework	2018
Establishment of one river gauge station	2019

Glossary of *Casco Bay Plan* Terms

Action: the tasks to be done by identified parties within the Plan's five-year timeframe

Adaptation (to climate change): adopting goals and strategies that anticipate and adjust to future climate conditions, and account for their impacts on natural and human communities

Adaptive management: a deliberate and iterative approach to decision-making in the face of uncertainty and rapid environmental change. This system involves ongoing data-gathering and annual assessments that reevaluate plans in light of new information.

Casco Bay: a large embayment within the Gulf of Maine, stretching from Dyer Point in Cape Elizabeth to Small Point in Phippsburg, which contains smaller bays (such as Maquoit and Middle)

Combined Sewer Overflow (CSO): pipes that release a combination of untreated sewage and stormwater during storm events due to inadequate capacity of the wastewater treatment system to handle the increased flow

Diadromous (fish): fish that between fresh and salt waters

Ecosystem: a dynamic community of living organisms interacting with one another and their physical environment

Estuary: a semi-enclosed coastal water body in which ocean waters mix with fresh water from riverine sources

Goal: the overarching results for Casco Bay that this five-year plan seeks to achieve

Habitat: the home environment on which plants and animals rely for food, shelter and reproduction

Strategy: the approach that CBEP and participating organizations will employ to achieve a stated Goal (relying on tools such as scientific research or monitoring; grant-making; policy-making; education; outreach; coordination; or project management)

Watershed: the geographic land area, bounded by higher ridges of land and built environments, within which water drains into a particular body of water. Casco Bay's watershed encompasses 985 square miles and includes portions of 48 municipalities. The lower Casco Bay watershed refers to the land area downstream of Sebago Lake.

Glossary of *Casco Bay Plan* Abbreviations

CAD: Confined Aquatic Disposal

CBEP: Casco Bay Estuary Partnership

CSO: Combined Sewer Overflow

GIS: Geographic Information System

MIMIC: Marine Invader Monitoring and Information Collaborative

NE/EFC: New England Environmental Finance Center

NERR: National Estuarine Research Reserve

NGO: Non-Governmental Organization

NOAA: National Oceanic and Atmospheric Administration

SEANET: Sustainable Ecological Aquaculture Network (University of Maine)

SET: Sediment Elevation Table

SPARROW: SPAtially Referenced Regressions On Watershed attributes (watershed modeling technique)

USEPA: United States Environmental Protection Agency

USFWS GOMCP: U.S. Fish and Wildlife Service—Gulf of Maine Coastal Program