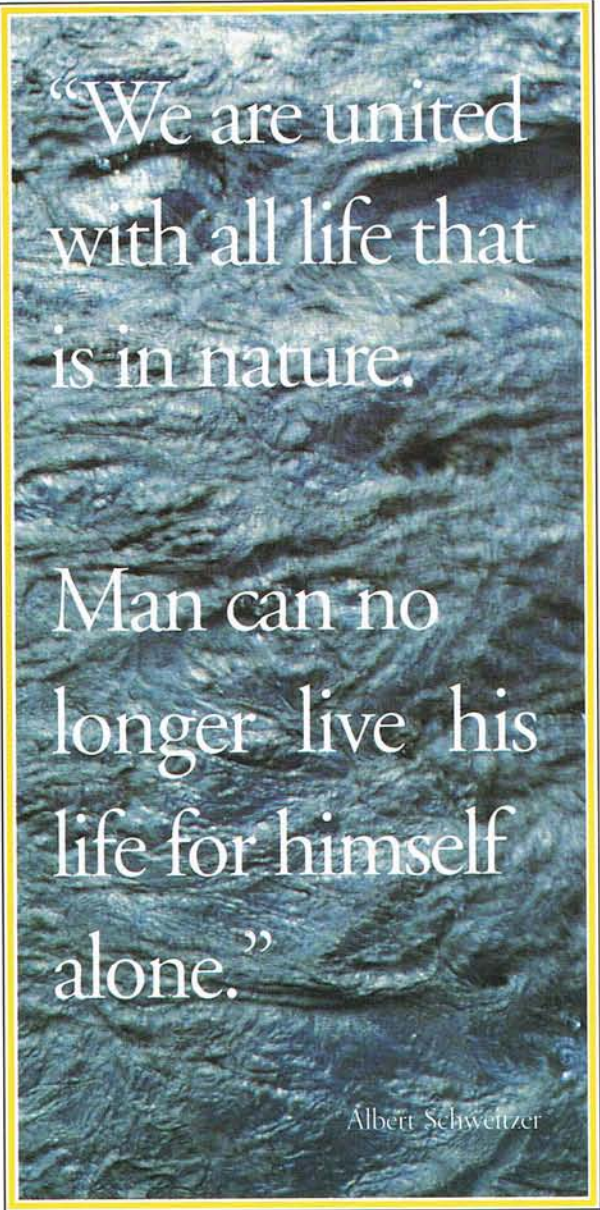




State
of the
Bay
REPORT

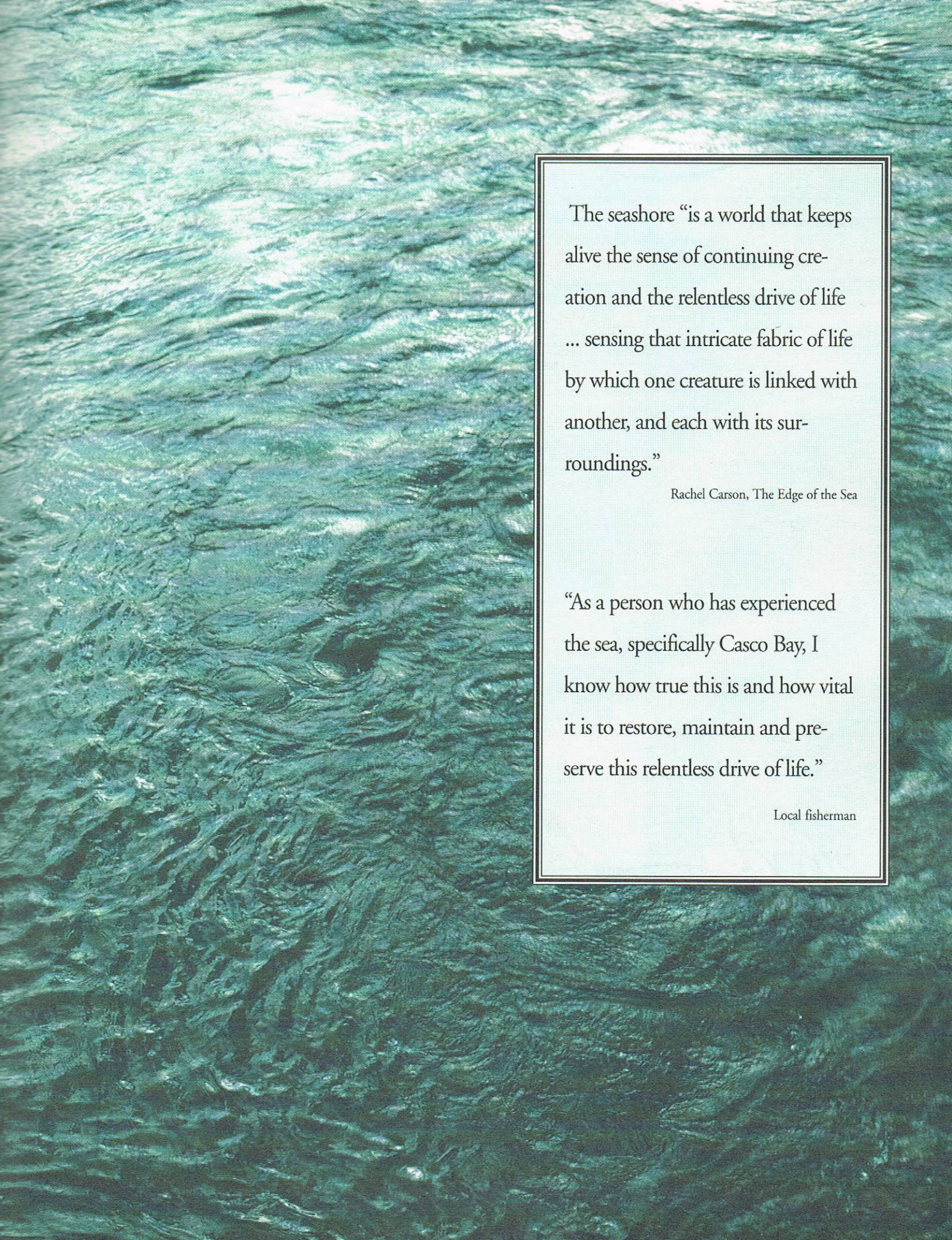
Casco Bay Estuary Project



“We are united
with all life that
is in nature.

Man can no
longer live his
life for himself
alone.”

Albert Schweitzer



The seashore “is a world that keeps alive the sense of continuing creation and the relentless drive of life ... sensing that intricate fabric of life by which one creature is linked with another, and each with its surroundings.”

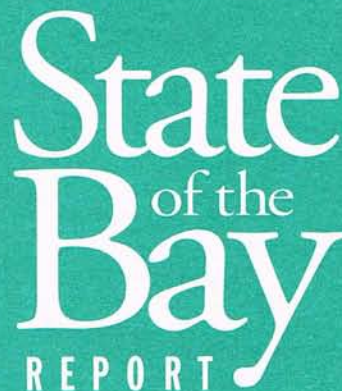
Rachel Carson, *The Edge of the Sea*

“As a person who has experienced the sea, specifically Casco Bay, I know how true this is and how vital it is to restore, maintain and preserve this relentless drive of life.”

Local fisherman



Casco Bay Estuary Project



State
of the
Bay
REPORT

Written by: Lee Doggett & Mark Smith

Designed by: Randall Landry

Geographic Information System
(GIS) maps by: Tom Burns

Production Coordinator: Robert Moore

Casco Bay Estuary Project Logo designed by
Andrew Morgan

Cover Photo: Randy Ury

Printed by: Print Mail of Maine

Linotronic Output: Pop It

Summer 1992

Special thanks to:

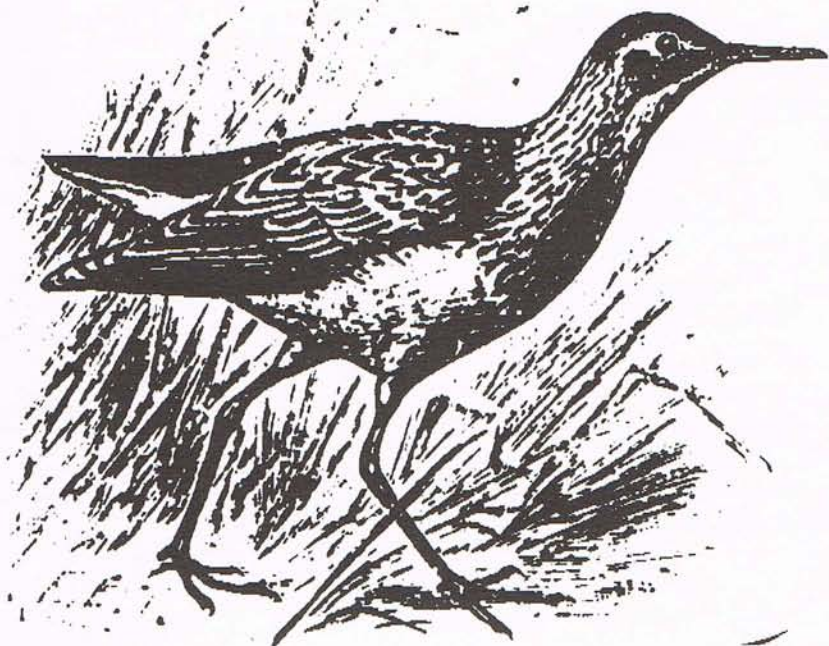
The Management Committee of the
Casco Bay Estuary Project

Dr. Betsy Brown, Colby College

Stewart Fefer, U.S. Fish and Wildlife Service

Chris Heinig, Intertide Inc.

John Sowles, Maine Dept. of Environmental Protection

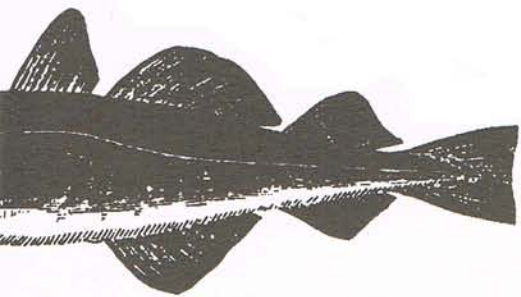


CONTENTS

Management Committee and staff for the Casco Bay Estuary Project	7
The Casco Bay Estuary Project Mission Statement	8
The Casco Bay Estuary Project	9
Profile of Casco Bay and It's Watershed	11
Commerce and Casco Bay	12
Recreation	13
Fisheries	13

The State of Casco Bay

Nutrients	14
Toxic Pollution	15
Pathogens	15
Habitat	18
Special Habitats	19
Flats	19
Eelgrass Beds	19
Salt Marshes	19
Freshwater Wetlands	20
Edge Zones	20
Islands	20
Exposed Rocky Shores	21
Subtidal Waters	21
Rivers & Streams	21



ISSUES

Stormwater Runoff and Combined Sewer Overflows	22
Development	24
Pre-existing Long Term Contaminants	24
Overboard Discharges and Septic Systems	25
Lack of Public Awareness	25

Activities in Progress

Sediment Contamination	26
Dirty History	26
Circulation and Flushing Rates	26
Regulatory and Management	26
National Estuary Program Review	27
Volunteer Monitoring	27
Data Management/Geographic Information System	27
Local Government	28
Public Outreach	28
Demonstration Projects	28
Local Government Technical Assistance	28
Pleasant River	30

What Happens Next?	30
--------------------	----

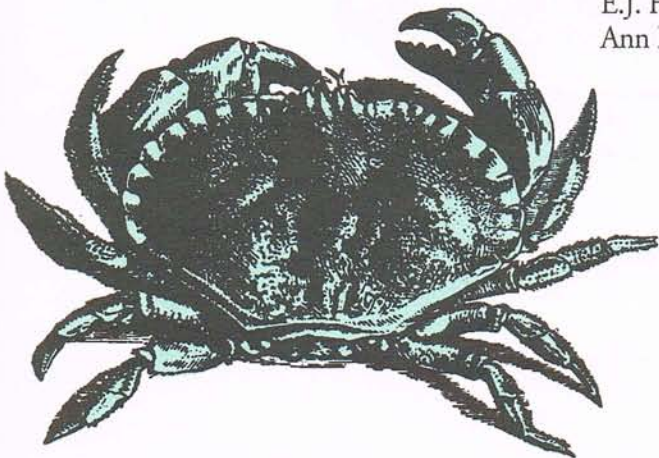
Glossary	31
----------	----

CASCO BAY ESTUARY PROJECT MANAGEMENT COMMITTEE

Jacqueline Cohen, Planner, Town of Freeport
John DelVecchio, Program Manager, Me. Department of Economic & Community Development
Jean Dyer, President, Casco Bay Island Development Association
Joseph Kelley, PhD, Dir. of Marine Geology, Me. Geology, Me. Geological Survey, Me. Department of Conservation
George Flaherty, Director of Parks and Public Works, City of Portland
Kevin Gildart, Assistant to the President, Bath Iron Works
Anne Hayden, Policy Development Specialist, Maine State Planning Office
Jeffrey Jordan, Assistant City Manager, City of South Portland
Brian Swan, Planning & Research Associate, Me. Dept. of Marine Resources
Donald Perkins, Jr., President, Friends of Casco Bay
Victoria Powers, Environmental Attorney
Debrah Richard, Deputy Commissioner, Maine Department of Environmental Protection
Gwen Ruta, Chief, Marine & Estuarine Protection Section, U.S. Environmental Protection Agency
Les Watling, PhD, Professor, University of Maine, Ira C. Darling Center
Clarice Yentsch, PhD, Principal Investigator, Bigelow Laboratory for Ocean Sciences

CASCO BAY ESTUARY PROJECT STAFF

Lee Doggett, Casco Bay Coordinator,
Maine Department of Environmental Protection
Mark Smith, Casco Bay Coordinator, U.S. Environmental Protection Agency
Tom Burns, Data Manager
Robert Moore, Public Outreach Coordinator
Paula Ashton, Administrative Assistant
E.J. Hampson, Program Assistant (*Through August 1992*)
Ann Rodney, U.S. Environmental Protection Agency



MISSION STATEMENT

developed by the Management Committee

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

To accomplish this mission, the Casco Bay Estuary Project will:

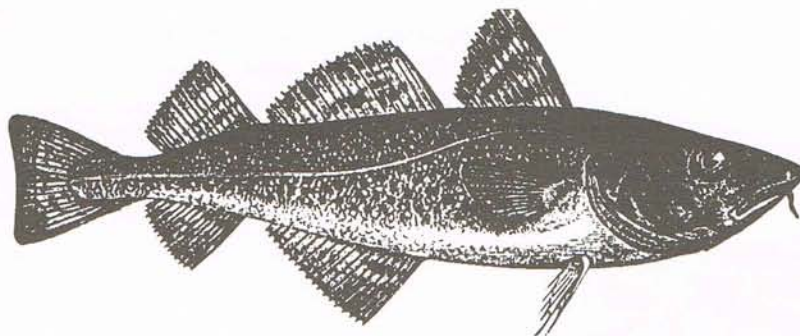


take steps to prevent, mitigate and remediate impacts from existing and potential pollution sources and habitat loss

support efforts to understand the Casco Bay ecosystem, including natural processes and the impact of human activities

support public education efforts to instill a responsible sense of public ownership of the Bay, especially among coastal and watershed communities

develop the management framework to sustain the Bay's resources and benefits





THE CASCO BAY ESTUARY PROJECT

National Estuary Programs:

Casco Bay Estuary Project (Maine)
Massachusetts Bays Program (Massachusetts)
Buzzards Bay Project (Massachusetts)
Narragansett Bay Project (Rhode Island)
Long Island Sound Study (Connecticut and New York)
New York-New Jersey Harbor Estuary Program (New York and New Jersey)
Delaware Estuary Program (Delaware, Pennsylvania and New Jersey)
Delaware Inland Bays Program (Delaware)
Albemarle-Pamlico Estuarine Study (North Carolina)
Indian River Lagoon National Estuary Program (Florida)
Sarasota Bay National Estuary Program (Florida)
Tampa Bay National Estuary Program (Florida)
Barataria-Terrebonne National Estuary Program (Louisiana)
Galveston Bay National Estuary Program (Texas)
Santa Monica Bay Restoration Project (California)
San Francisco Estuary Project (California)
Puget Sound Estuary Program (Washington)

Other Major Protection Programs:

Gulf of Maine Initiative
Lake Champlain Program
Chesapeake Bay Program
New York Bight Restoration Program
Great Lakes Water Quality Agreement
Gulf of Mexico Program

Casco Bay became part of the U.S. Environmental Protection Agency's National Estuary Program in April, 1990. Casco Bay was nominated because of public concern about environmental degradation in the Bay.

Casco Bay is not in the pristine condition it once was -- when native Americans and early settlers spent their summers gathering the vast resources of the Bay to tide them over the winter. Over the years, the Bay has been adversely impacted by pollution and other human activities. Although many sources of pollution are now treated, questions remain about the ecological integrity of the Bay and whether enough effort is being undertaken to protect that integrity.

Inclusion in the National Estuary Program means that federal funds are available for the first time to focus on Casco Bay and its management. The Casco Bay Estuary Project has produced this document to provide the public with baseline information about Casco Bay. Studies currently funded by the Casco Bay Estuary Project are described in this document and will result in a more comprehensive understanding of Casco Bay and its watershed.

With the help of the local governments and the public, the Casco Bay Estuary Project intends to explore and recommend management strategies designed to ensure protection of the Bay. Most land use decisions in Maine are made at a local level on a town-by-town basis. There is no entity coordinating the activities of the 39 municipalities and one township (hereafter referred to as 40 towns) in the watershed. Land use decisions by upstream towns already have resulted in impacts to downstream towns. The sense of watershed and watershed management is lacking. Lack of coordinated management also results in missed opportunities to take advantage of the scarce financial resources available from the state and federal government.

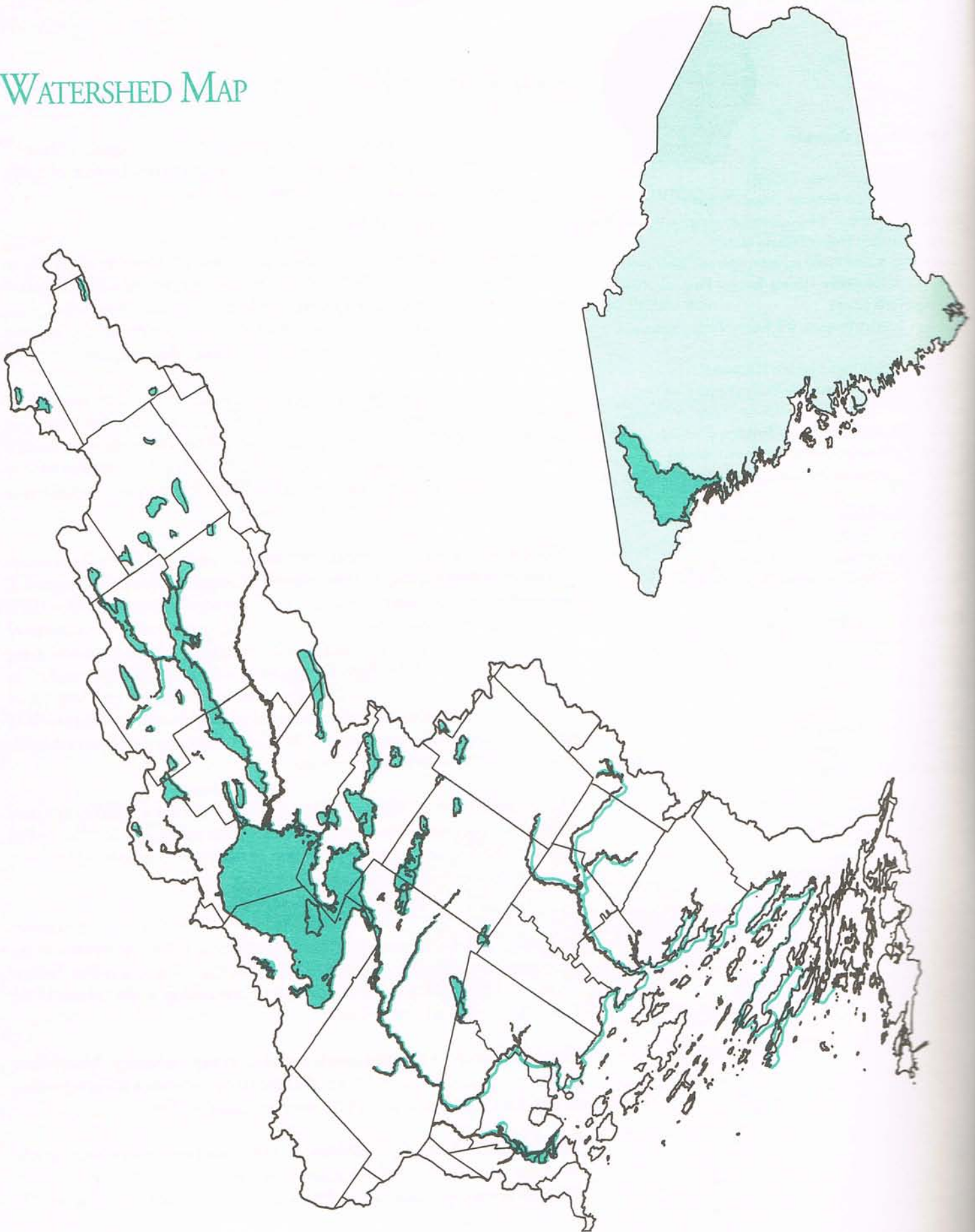
Not all residents of the 40 towns in the watershed will feel an affinity to Casco Bay. Most, however, will have a special stream, river, marsh, lake or other natural area that they want to protect. Protection of these special areas will ultimately result in the protection of Casco Bay.

The bay and the water resources in the Casco Bay watershed belong to the citizens of Maine. The federal and state governments are assisting the citizens in the development of the plan to protect these resources. The Casco Bay Estuary Project will be working to develop a sense of stewardship in the citizens of the Casco Bay watershed that will extend beyond the life of the five year project.

The quality of life in Maine is closely linked to its natural beauty. Most Maine people recognize that link and, once educated about necessary actions, are willing to take the extra steps to protect the natural beauty of Maine.

The Casco Bay of tomorrow will depend on the collective vision of today. Public participation in the Casco Bay Estuary Project is critical to defining that vision. The goal of the Casco Bay Estuary Project is to bring that collective vision to life.

WATERSHED MAP



PROFILE OF CASCO BAY AND IT'S WATERSHED

The spectacular coastal landscape in Casco Bay is principally related to its geological history. The structured and complex nature of the bedrock is responsible for the rocky headlands and numerous coves, bays and islands. The glaciers that receded 12,000-13,000 years ago provided the boulders, cobbles, gravel, sand and mud which, with the help of the ocean, filled in around the bedrock and formed the classic Maine shoreline that extends from Casco Bay to the border with Canada.

Casco Bay has 578 miles of shoreline including 758 islands. A number of the islands have year round residents. Many other islands are uninhabited by humans and serve as home for a variety of wildlife.

The boundaries of the area included within the Casco Bay Estuary Project extend from Two Lights at Cape Elizabeth on the west to Cape Small in Phippsburg on the east. The Fore and Stroudwater Rivers, the Presumpscot River and the Royal River are the principal rivers flowing into Casco Bay. Water from numerous lakes, rivers and streams flows into Casco Bay. Therefore, all 40 towns in the watershed all the way up the Crooked River to Bethel are included in the Casco Bay Estuary Project.

Towns in the Casco Bay Watershed (40):

Coastal (12):

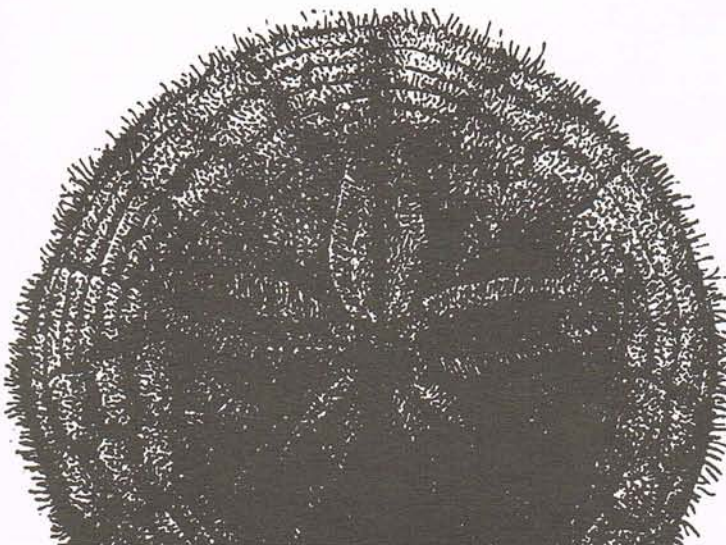
PHIPPSBURG
WEST BATH
HARPSWELL
BRUNSWICK
FREEPORT
YARMOUTH
CUMBERLAND
FALMOUTH
PORTLAND
SOUTH PORTLAND
CAPE ELIZABETH
SCARBOROUGH

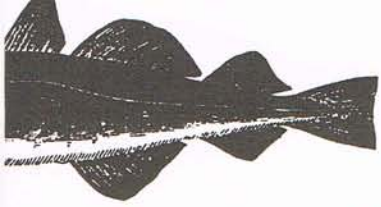
Inland (12):

GORHAM
WESTBROOK
BUXTON
WINDHAM
STANDISH
POLAND
NEW GLOUCESTER
GRAY
AUBURN
DURHAM
POWNA
NORTH YARMOUTH

Upper Watershed (16):

BETHEL
STONEHAM
ALBANY TOWNSHIP
GREENWOOD
NORWAY
WATERFORD
SWEDEN
DENMARK
HARRISON
BRIDGTON
NAPLES
RAYMOND
OTISFIELD
CASCO
SEBAGO
BALDWIN





COMMERCE AND CASCO BAY

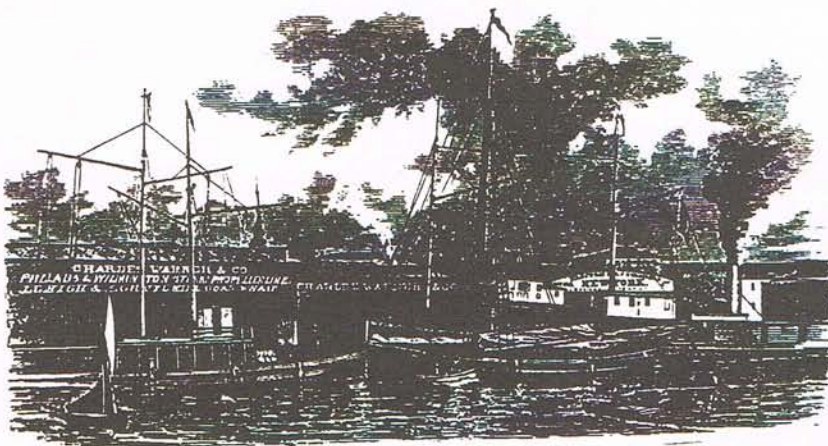
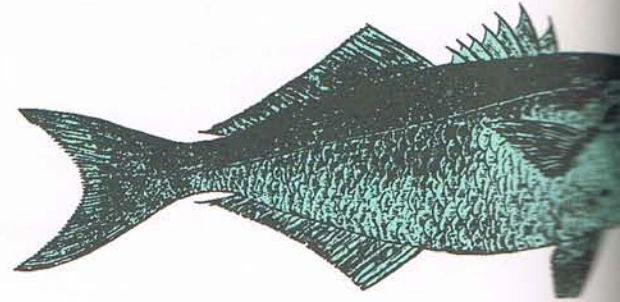
The Fore River serves as the port of Portland, which is the only port for large vessels in Casco Bay. The port is bordered by the cities of Portland and South Portland. A variety of goods are handled in the port including petroleum, bulk cargo (coal, salt, etc.) and bagged or packaged bulk cargo. Petroleum shipments are by far the largest percentage of cargo being off-loaded in the port. From the 1960's into the 1970's, Portland was the second largest oil handling port on the East Coast. The reduction in oil handling since that time is due to the fact that less oil is piped by Portland Pipeline from Portland to Canada. Recently, Portland Pipeline announced plans to increase tanker shipments to Portland in the future.

Bath Iron Works is another user of the port of Portland. Large military vessels are refurbished in the large dry dock facility on the Portland waterfront.

The Portland Fish Exchange, also located on the waterfront, is the only fish auction north of Massachusetts. Cod, haddock, flounder, squid, scallops and lobster are among the seafood unloaded from fishing boats on the Portland waterfront. Their catch is principally from the Gulf of Maine; some is from Casco Bay.

Eleven private cruise lines plus the ferries of Casco Bay Lines take numerous passengers on trips across and around Casco Bay. In recent years, approximately 15 cruise ships carrying 7,000 - 12,000 passengers have stopped in Portland each summer. The cruise ship, Scotia Prince, provides an important link between the ports of Portland and Yarmouth, Nova Scotia. The Scotia Prince operates from May to October and at peak season arrives and leaves the port of Portland every night.

Shipping oil and cargo, refurbishing vessels, fishing and transportation are important commercial activities that rely on the port of Portland and Casco Bay.



RECREATION

The beautiful blue waters, classic Maine rocky coastline and the numerous islands and peninsulas have attracted tourists for over a century.

Tourism and recreation together contribute more than \$250 million to the economy of the Casco Bay region, according to a 1986-88 estimate.

Casco Bay is an excellent area for recreational boating, both sail and power. The hundreds of islands provide visual interest. These islands also provide protection from the open ocean. There are approximately 1,900 slips in 19 marinas and 3,400 moorings controlled by the towns. Sea kayaking and wind surfing have become popular in Casco Bay in recent years. The Bay also is used by a variety of people for bird watching, recreational fishing and hunting.

FISHERIES

The 1990 fisheries landings were worth about \$47 million, however, actual landings may be 10-33% higher.

Portland is the principal port where fish and shellfish are landed in Casco Bay. Total fish and shellfish landings for Cumberland and Sagadahoc County for 1990 were valued at about \$47 million (Department of Marine Resources). The direct sales of lobsters, soft-shelled clams, scallops, shrimp and crabmeat to restaurants and the public are not included in the landings and, if included, may increase the \$47 million figure by 10-33 percent. The fisheries landings data do not specify the pounds and value of fish and shellfish actually landed in Casco Bay. The numerous lobster traps in Casco Bay attest to the fact that there is a thriving lobster industry in the Bay at present. Most of the fish landed in Portland come from the Gulf of Maine; however, Casco Bay may have served in an important role as a nursery for some of these fish when they were juveniles.



THE STATE OF CASCO BAY

Casco Bay provides a major link between open ocean, fresh water and the land. The Bay is extremely productive and provides essential food, cover, migratory corridors and breeding and nursery areas for a wide variety of plants and animals. Clams, lobsters, marine worms, crabs, sea urchins, mussels, scallops, fish, European oysters, waterfowl and seaweed are commercially and recreationally important resources in the Bay. Seals, ospreys, herons and numerous waterbirds add to the beauty and diversity of the Bay.

A comprehensive analysis of the condition of Casco Bay's water, sediments, biological resources and habitat is lacking. Therefore, the following is a preliminary assessment based on general observations and limited studies.

NUTRIENTS

Nutrients such as nitrogen, phosphorus and carbon are essential for the growth of plants and animals, but when supplied in excessive amounts can result in ecologically harmful algae blooms. In salt water, nitrogen is generally the nutrient that controls plant growth while phosphorus is the nutrient of concern in lakes.

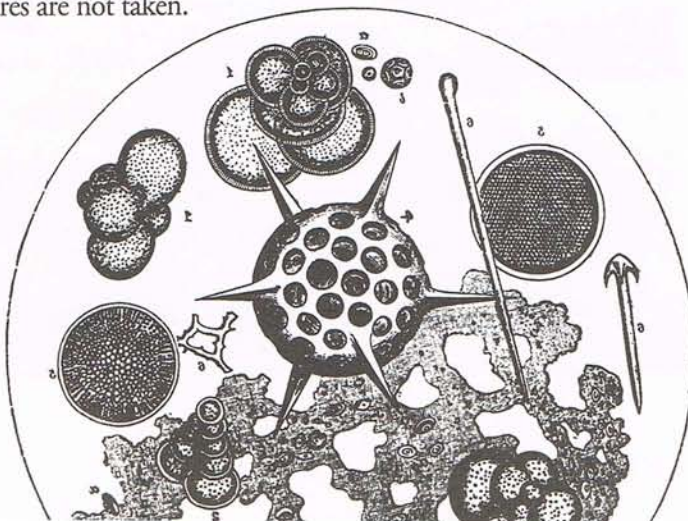
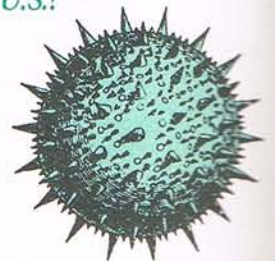
Residents living around Casco Bay have reported numerous algae blooms in recent years. Since no records have been kept and no scientific monitoring has been conducted, it is difficult to tell if there is a current problem in Casco Bay or if a problem is developing.

In the fall of 1988, massive numbers of shellfish and other animals died in Maquoit Bay in Brunswick because the oxygen was depleted when phytoplankton bloomed in the bay and later died. It is unknown whether localized nutrient enrichment contributed to the problem. It is well known, however, that serious nutrient enrichment problems exist to the south in Cape Cod, Narragansett Bay, Long Island Sound and Chesapeake Bay. The "kill" in Maquoit Bay suggests problems that might someday occur there and elsewhere in Casco Bay if preventive measures are not taken.

Evidence of a productive environment-- seals, birds, lobster buoys -- is everywhere.

Are there warning signs that some areas of the Bay are being overloaded with nutrients?

Should we take measures to avoid the problems being experienced by other estuaries and bays along east coast of the U.S.?



TOXIC POLLUTION

Toxic pollution is principally concentrated in the Fore River, Back Cove and the Presumpscot River.

Toxic pollutants include toxic metals, PCBs, petroleum hydrocarbons and a host of other chemicals. What makes a substance a "toxic pollutant" is a matter of its chemical form, quantity and availability to organisms. Metals that are a dietary necessity at low concentrations may be deadly at higher concentrations. The presence of a toxic pollutant in sediments or animal or plant tissues is not necessarily an impending human health hazard.

Sediments are integrators of pollution in aquatic systems. Toxic pollutants in sediments may become available to animals living in and feeding on material in the sediments. Toxic pollution in sediments is principally concentrated in the area around Greater Portland in the Fore River, Back Cove and in and off the mouth of the Presumpscot River. Other localized contaminated sites may exist elsewhere in the Bay. The Casco Bay Estuary Project soon will be reporting the results of a bay-wide sediment contamination study conducted in the summer of 1991 in a separate document.

Animals feeding on other animals that contain toxic pollutants is the way that these pollutants are passed from one animal to the next. Animals may accumulate toxic pollutants in their bodies over time, a process known as bioaccumulation. There are insufficient data to determine if toxic pollution is negatively impacting the health of biological communities in Casco Bay. Monitoring data show that some toxic pollutants are being taken up by mussels in the Fore River and the Presumpscot River. Flounder off Casco Bay have been found to have toxic pollutants in their livers. In addition, the bottom dwelling animal community appears to be altered in the inner Fore River, although there is no proven cause.

While it appears that toxic pollution levels have remained the same over the last decade, there are no data to determine over the long term if the pollution is getting better, worse or staying the same. It is also unknown if toxic pollutants are being concentrated at unhealthy levels in fish, seals and birds that feed in Casco Bay. Research has shown that adult and juvenile winter flounder, common inhabitants in the Bay, may develop tumors or abnormalities when exposed to toxic pollutants. The health of winter flounder and other fish in Casco Bay is unknown.

PATHOGENS

In 1990, 43.4% of the 11,112 acres of clam flats in Casco Bay were closed.

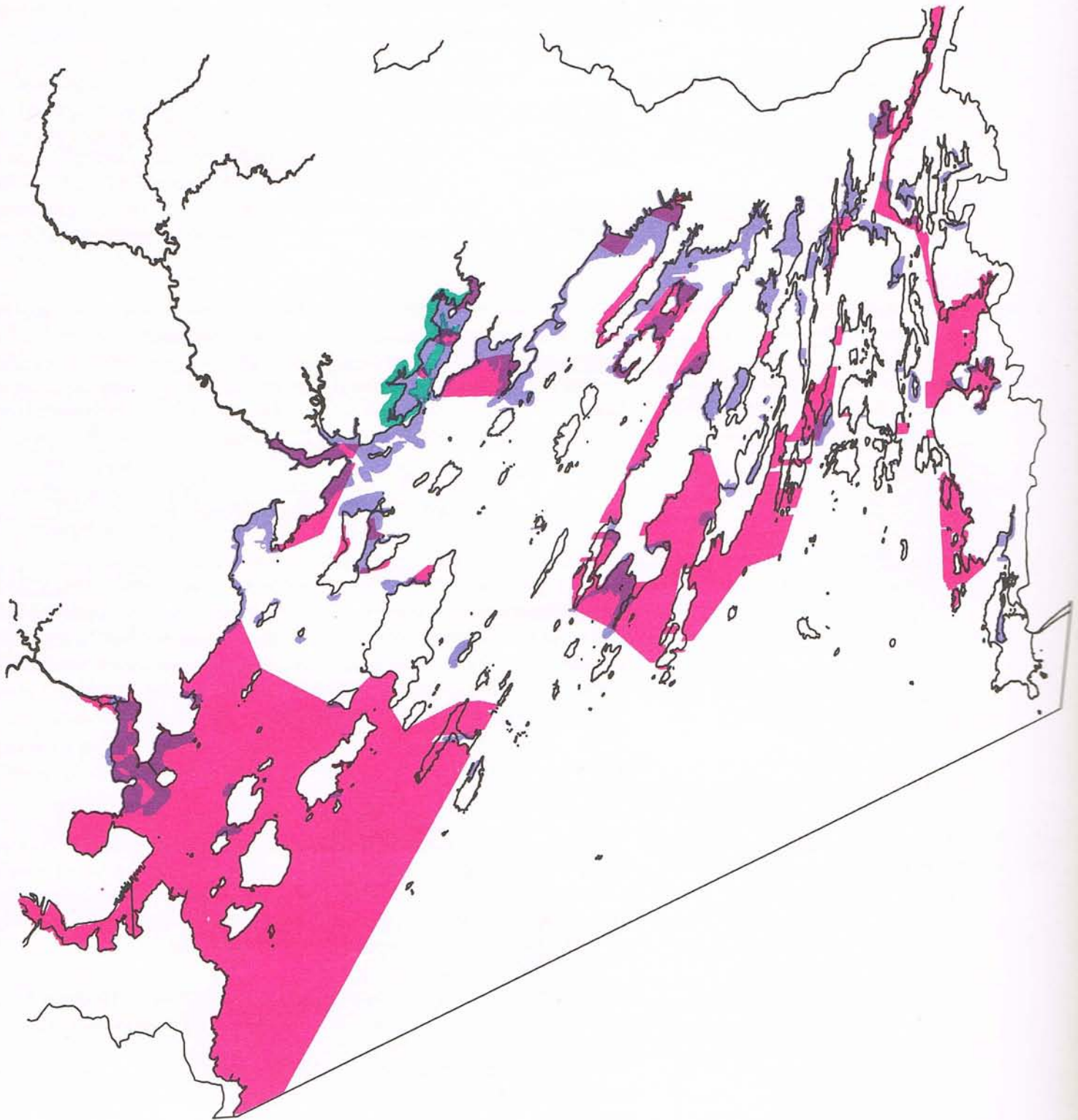
Pathogens are agents such as viruses and bacteria that can cause diseases in humans. The effect of pathogens is two-fold. Humans may become sick by either eating contaminated shellfish or by swimming in contaminated waters. Closed and warning signs have been posted in the summer at East End Beach and at swimming areas on Peaks Island because of high levels of pathogens.

There are over 2,500 licensed shellfish harvesters in Casco Bay and between 27,000 and 61,000 bushels of clams have been landed in Cumberland County each year over the past decade. Over 43 percent of the 11,112 acres of clam flats in Casco Bay were closed in the summer of 1990 which is up from the 38 percent closure calculated for 1989. With such a large percentage of flats closed, coastal towns have had to carefully manage their available resource.

CASCO BAY SHELLFISH AREAS

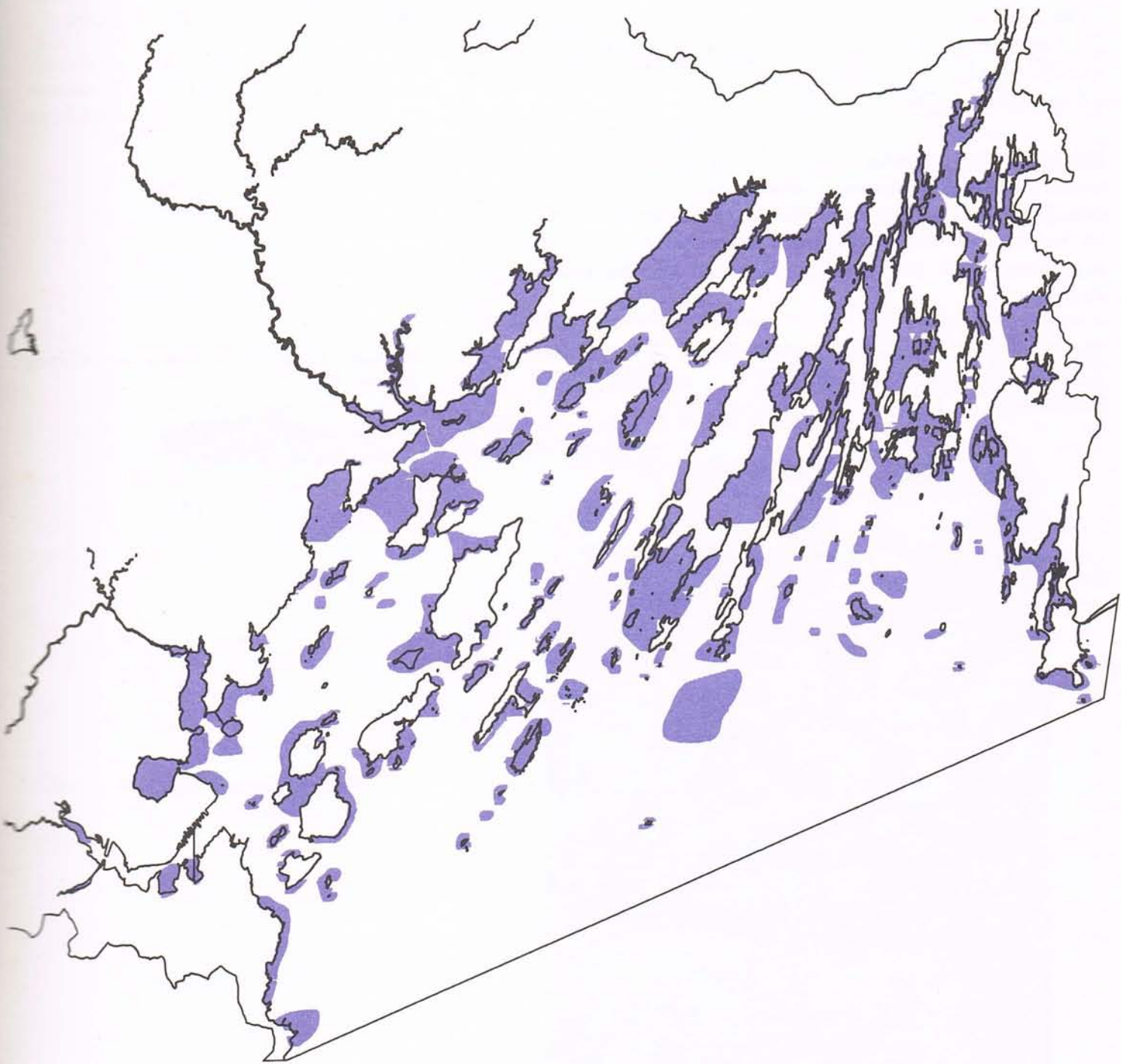
% Closed 1990 43.4
1989 37.2

- All Shellfish Beds. (excluding sea scallops)
- Restricted or Conditional Shellfish Areas
- Closed Shellfish Areas
- Open Water

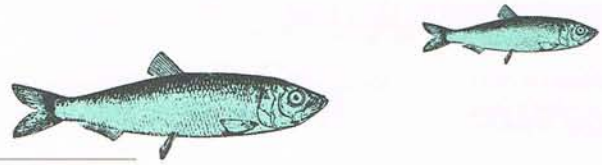


MARINE BIRD AREAS

Maine Department of Inland
Fisheries & Wildlife



HABITAT



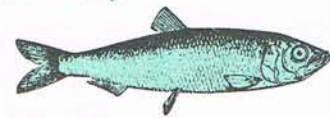
Casco Bay contains a variety of habitats, including marshes, shallow tidal creeks and flats, rocky headlands, numerous islands and ocean waters. Rocky shores are the most noticeable habitat in the Bay; however, the flats have the largest acreage. The Casco Bay watershed consists of forests, fields, lakes, streams, rivers and freshwater marshes. The integrity of these habitats is critically important to the well-being of Casco Bay.

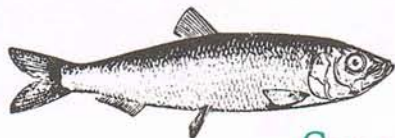
Casco Bay habitats include salt marshes, mudflats, eelgrass beds, freshwater wetlands, rocky headlands, numerous islands and ocean waters.

Habitat destruction in the Casco Bay watershed is hard to assess because there are no data. Much of the destruction has amounted to a little bit here and there. The cumulative impact on the habitat and the plants and animals that depend on it is unknown. Salt marshes, eelgrass beds, freshwater wetlands and edge zones may be particularly at risk. Birds and seals on islands may be at risk because of human disturbance.

The significant habitats in Casco Bay are areas that harbor a wide variety and number of plants and animals and therefore warrant special attention. These special habitats are described on the following pages.

Habitat protection is important to the well being of Casco Bay.





SPECIAL HABITATS

FLATS

Flats are extremely productive, harbor important commercial species and provide food for migrating shorebirds.

Flats are the most characteristic intertidal habitat in Casco Bay. The flats form in relatively sheltered bays and are principally composed of mud or sand. Flats are especially important environments because they support a rich animal community including commercially harvested clams, sandworms and bloodworms. Flats are also home for the Baltic clam, green crabs, numerous tiny worms and shrimp-like animals. These shrimp-like animals are the favored food of migrating shorebirds. The flats in the upper Fore River and Back Cove in the Greater Portland area and Maquoit and Middle Bays in Brunswick are the principal areas where migrating shorebirds congregate to feed in Casco Bay.

The flats in the Brunswick and Harpswell area have southern species such as quahogs that are isolated from their counterparts in southern New England. Other areas may have isolated pockets of Virginian oysters. There is evidence that one of these pockets of oysters used to be in the Fore River. These isolated populations are particularly sensitive because they cannot draw on the larger population for replenishment when their populations become reduced because of natural cycles or stress caused by pollution or disturbance.

Mussel bars are found in association with flats. The formation begins with a dense set of mussels on stones, shells or other debris. When the first mussels become established other mussels attach to them. The mussel bar becomes a habitat itself and is home to a wide variety of animals. Mussel bars tend to be ephemeral and are subject to damage or destruction by storm waves and floating ice.

EELGRASS BEDS

Eelgrass adds another dimension to the flat habitat by providing shelter and substrate for attachment.

If conditions are favorable, eelgrass grows on intertidal and shallow subtidal flats. Once the eelgrass becomes sufficiently dense, it provides protection for fish, shellfish and other animals. In addition, eelgrass beds are very important substrates for attachment of plants and animals which in turn are food for ducks and geese. These beds are also important in reducing current velocities thus trapping sediments leaving and entering flats. Eelgrass beds provide an important three dimensional habitat for animals living in the sediments, plants and animals living attached to the eelgrass plants and for fish living among the grasses.

SALT MARSHES

Salt marshes shelter a variety of birds, fish and other animals.

Salt marshes are productive elements of coastal areas worldwide. Casco Bay, unlike areas south along the Atlantic Coast, does not have numerous expansive salt marshes. However, significant areas of salt marsh exist around sheltered flats and these marshes are extremely productive areas.



The wide variety of organisms that are found in and around salt marshes is evidence of their high productivity. Ribbed mussels can be found protruding from the small fringe marshes. Small fish feed in the marsh during high tide and are in turn preyed upon by herons and larger fish. Muskrats feed on marshgrass and use the grass blades to construct their mounded homes. Red-winged blackbirds and sharp-tailed sparrows consume marsh grass seeds. The intertidal flats along the edge of the creeks harbor animals similar to those in the flat habitat. The creeks provide cover and food for black ducks and mallards.

Salt marshes filter stormwater and help prevent flooding.

Salt marshes act as a filter for stormwater flow from upland developments and help to regulate nutrient flow to adjoining waters. Marshes also act as giant sponges during storms, and help to reduce damage from flooding.

FRESHWATER WETLANDS

Freshwater wetlands include marshes, bogs and wooded swamps. They are valuable because they aid in controlling floods, recharging groundwater supplies, regulating nutrients and maintaining minimum stream flows. Many species of reptiles, amphibians and wildlife depend on freshwater wetlands during certain phases of their life cycle. Approximately 100 species of birds breed in freshwater wetlands and some only breed in wetlands. Forested wetlands are especially important for the hole-nesting wood ducks and mergansers. All the habitat requirements for muskrats are found in freshwater wetlands. Forested wetlands provide important winter habitat for deer. Other wetland users include red fox, moose, raccoon, mink, otter, black bear and beaver.

Freshwater wetlands aid in controlling floods and are habitat for reptiles, amphibians, vertebrates and a variety of wildlife.



EDGE ZONES

The riparian (streambank) zone and the 578 miles of edge habitat adjacent to the shoreline of Casco Bay are important links between the terrestrial (land) ecosystem and the wetlands or water. Many species of birds and mammals use these areas for shelter, feeding and nesting or raising young. This riparian or edge habitat protects the abundant and diverse species that use the adjacent open water. These habitats also act as filters for stormwater and groundwater flow from upland development.

Edge zones protect birds and mammals and act as filters of pollutants.

ISLANDS

Casco Bay contains 758 islands. Islands are important habitats because they provide large intertidal areas for feeding as well as upland areas for nesting for seabirds. Islands are used by land birds, shorebirds and geese during the migration season. Islands also are used by ospreys, seabirds and wading birds for nesting habitat. Seals use rocky ledge islands (known as "haulouts") for breeding, resting and sunbathing.

Islands are important habitats for birds and seals.



EXPOSED ROCKY SHORES

Tidepools, cracks and crevices on exposed rocky shores harbor diverse assemblages of plants and animals.

Rocky shores that are exposed to wave action provide a unique opportunity for the public to view the bounty of Casco Bay. Tidepools, cracks and crevices harbor diverse assemblages of plants and animals including periwinkles, whelks, mussels, crabs, sea urchins, starfish and shell-less snails. Occasionally, eel, rock blenny and sculpins are found in tidepools.

SUBTIDAL WATERS

Birds, seals, fish, lobsters, crabs and numerous other plants and animals depend on the habitat provided by the waters of Casco Bay.

Subtidal waters are the primary habitat for a broad spectrum of organisms. In Casco Bay, there are two basic types of bottom habitat: rock and sediment. Kelp, lobsters, Jonah crabs, sponges and sea urchins are principally found on rocky habitats while rock crabs, European oysters, scallops and a variety of marine worms prefer a sedimentary habitat. Shrimp migrate inshore from the Gulf of Maine in the winter to breed and prefer a sedimentary habitat when they are on the bottom.

Fish populations in Casco Bay are dominated by bottom feeders including winter flounder, pollock, sculpin, skate and cod. These fish feed on the diverse and plentiful supply of small bottom dwelling clams, marine worms and shrimp-like animals present in the sediments in the Bay. The Atlantic herring, alewife, Atlantic menhaden (pogy), American sand lance and Atlantic shad live in the water column and feed on microscopic plants and animals. Bluefin tuna, the hakes, spiny dogfish, bluefish, Atlantic mackerel and striped bass are important summer visitors to Casco Bay.

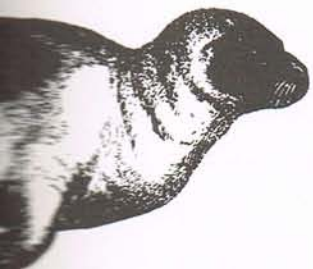
Water birds use open water for feeding, molting, migrating and wintering. In addition several raptors, including osprey and the endangered bald eagle, use open water areas for feeding.

Seals use Casco Bay for feeding. The harbor seal is the only resident marine mammal, but the Bay periodically supports important populations of harbor porpoises. Other marine mammals that may occasionally feed in Casco Bay waters include finback, minke and humpback whales. The humpback is a federally listed endangered species and all whales are protected marine mammals.

RIVERS & STREAMS

Anadromous fish, trout, perch, pickerel, bass, waterbirds, muskrat, beaver and otter all use the rivers and streams in the Casco Bay watershed as habitat.

The numerous streams and rivers in the Casco Bay watershed serve as important habitat for resident and anadromous fishes as well as waterbirds, muskrats, beavers and otters. Anadromous fish such as alewife, smelt, shad and possibly salmon travel from Casco Bay upstream to freshwater to spawn. Important resident recreational fish in the rivers and streams include several species of trout, perch, pickerel and bass. The landlocked salmon, a prized recreational fish, lives in Sebago Lake and spawns in the upper Casco Bay watershed. Birds, seals, fish, lobsters, crabs and many other plants and animals depend on the habitat provided by the waters of Casco Bay. Anadromous fish, trout, perch, pickerel, bass, waterbirds, muskrat, beaver and otter all use the rivers and streams in the Casco Bay watershed as habitat.



ISSUES

The Management Committee of the Casco Bay Estuary Project identified five preliminary issues of concern to the project:

- stormwater runoff and combined sewer overflows (CSOs),
- development,
- pre-existing long term contaminants,
- overboard discharges and septic systems, and
- lack of public awareness.

The order of priority of these five issues has yet to be determined. Many of these issues are interrelated and most fit under the broad category of development. During the development of the preliminary management plan (due fall, 1992), issues will be defined in greater detail.

STORMWATER RUNOFF

Stormwater running off parking lots, roads, fields and lawns adds pollutants to Casco Bay. When stormwater runs across parking lots, roads and other impervious surfaces the speed of runoff increases and may result in erosion and washouts. Stormwater is considered to be a source of nonpoint source pollution.

COMBINED SEWER OVERFLOWS

Combined sewers are pipes that carry both sewage and stormwater. If the capacity of the sewage treatment plant is exceeded, a mixture of stormwater and sewage is discharged untreated through the Combined Sewer Overflows (CSOs). Approximately 75 existing CSOs have the potential to discharge into Casco Bay or its tributaries. These CSOs are located in the cities of South Portland, Portland and Westbrook.

No matter how stormwater is conveyed, the result is the same: pathogens, toxic pollutants, sediments and nutrients are washed into Casco Bay.

PRELIMINARY ISSUES:

Stormwater runoff/CSOs

Development

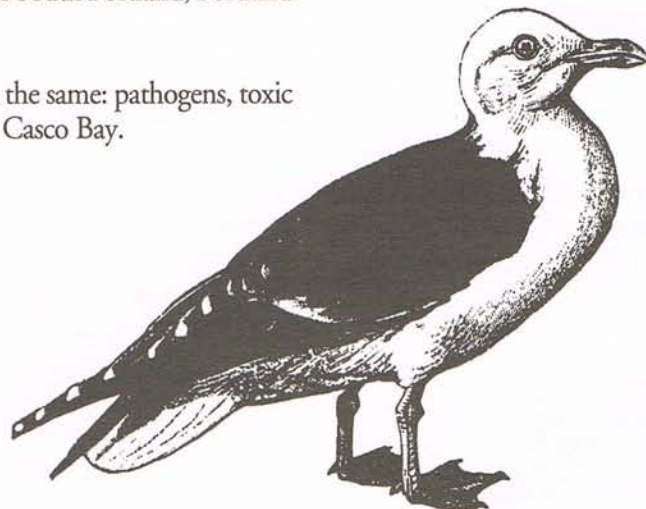
Pre-existing long term contaminants

Overboard Discharges/Septic Systems

Lack of Public Awareness

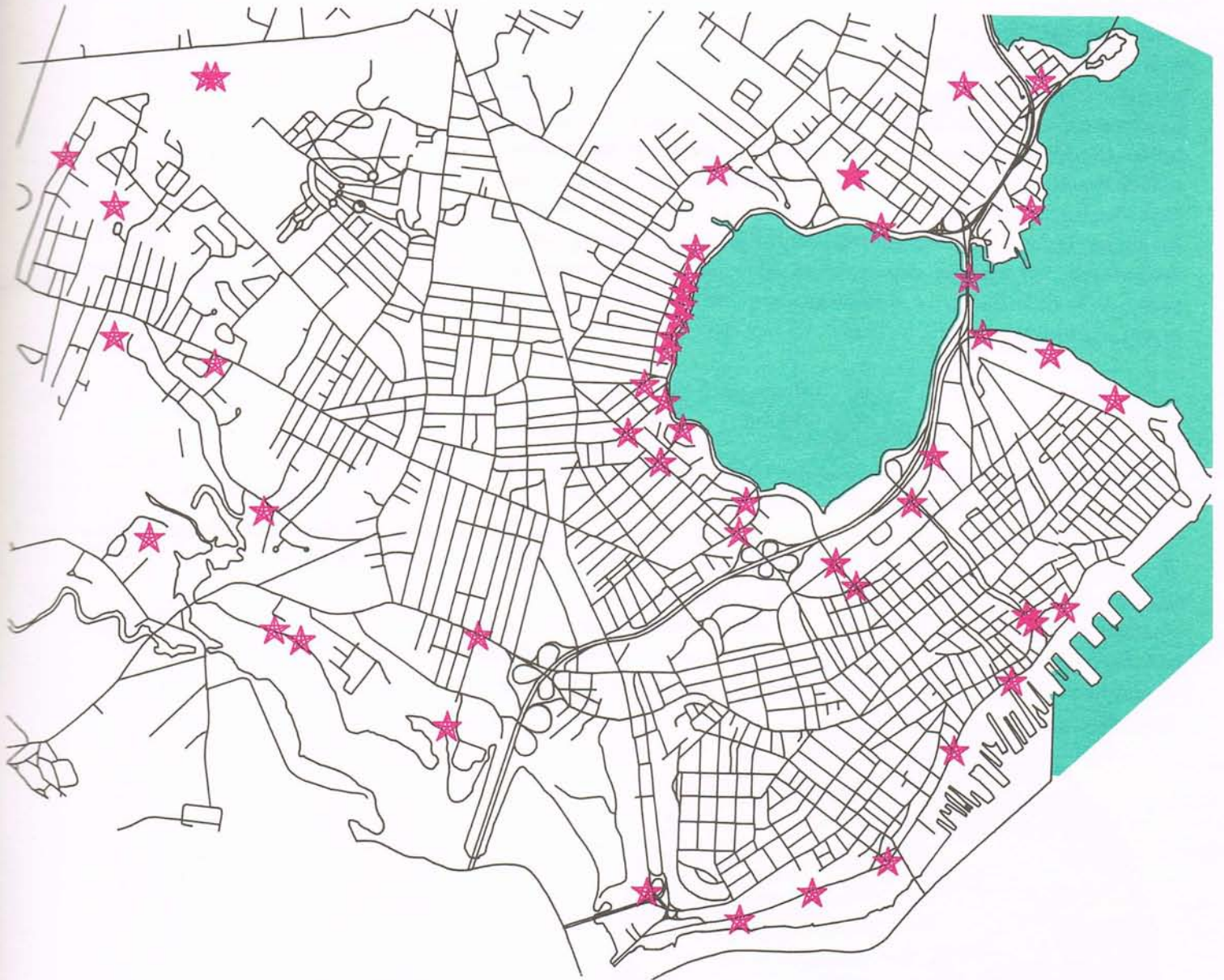
Stormwater carries pathogens, toxic pollutants, sediments and nutrients into Casco Bay.

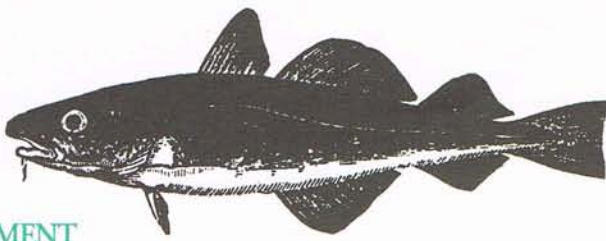
No matter how stormwater is conveyed -- CSOs, direct runoff, in streams or in pipes -- the result is the same: pollutants are washed into Casco Bay.



LOCATIONS OF
COMBINED SEWER
OVERFLOWS.

PORTLAND, MAINE





DEVELOPMENT

The Casco Bay watershed has experienced increased development in the past 25 years. Development in the lower Casco Bay watershed (downstream of the outlet of Sebago Lake) has been particularly intense. In the mid-1980's the rapid development pressures and thriving economy resulted in the passage of state Growth Management legislation in 1988. Since that time the economy has been depressed and the development pressures have lessened. As a consequence, the funding for comprehensive planning and implementation has been reduced. However, most towns in the lower Casco Bay watershed see the value of planned development and are proceeding with comprehensive planning. Appropriate development can occur when public resource protection is carefully balanced with protecting individual rights.

Development takes many forms. The most obvious form is the increase in parking lots, roads, buildings and other impervious surfaces. Less apparent forms include the incremental filling of wetlands and soil washing off land cleared of vegetation for the construction of roads, buildings and lawns. Past development has resulted in dams and culverts that restrict fish passage. Future impacts from development may result in areas where shoreline stabilization activities have occurred. As sea level rises, the mudflats and other intertidal habitats will be lost in areas stabilized by seawalls, bulkheads, rip-rap, etc.

PRE-EXISTING LONG TERM CONTAMINANTS

The toxic pollutant load in Casco Bay reflects past and current discharges from a variety of sources. There is public concern about the level of contamination, whether or not the contamination is getting worse, and whether the contamination is causing environmental effects. The Casco Bay Estuary Project has begun to address some of these concerns by funding a sediment contamination study and a "dirty history" study. These studies are described in the section on Activities in Progress.

Acres of parking lots, miles of roads and numbers of buildings have increased dramatically in the Casco Bay watershed in the past 25 years.

Toxic pollution in Casco Bay comes from past and current discharges

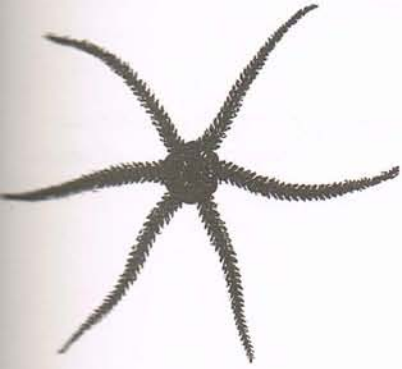
OVERBOARD DISCHARGES/SEPTIC SYSTEMS

Numerous clam flats are closed in Casco Bay because of discharges from overboard discharge units and malfunctioning septic systems.

Discharges from overboard discharge units and malfunctioning septic systems result in closure of clam flats. Many septic systems in the Casco Bay watershed are old and were installed before the plumbing code was updated. Many have not been maintained for years. The runoff from inadequate and failing septic systems results in failed water quality tests and shellfish closures or restrictions. The problem is not just along the immediate coast; many streams entering Casco Bay carry a high load of pathogens to the Bay.

Numerous straight pipe discharges to Casco Bay have been replaced by overboard discharge units with the hope of cleaning up coastal waters. There is now little unsightly raw sewage entering the Bay. Unfortunately, there are permanent shellfish closures around these units because of the potential threat of bacterial discharge if the unit is not operating properly. There also is concern about environmental effects from the discharge of the toxic pollutant chlorine that is used as a disinfectant in overboard discharge units.

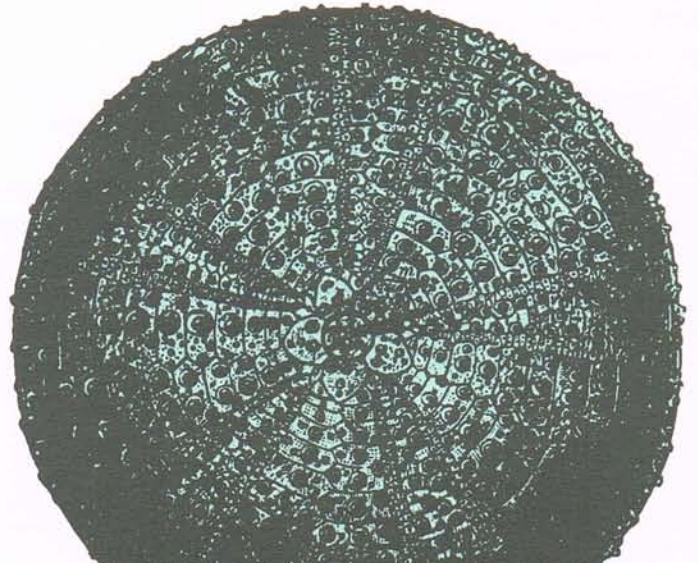
Both overboard discharge units and septic systems were not designed to remove nitrogen, a nutrient of concern in Casco Bay.



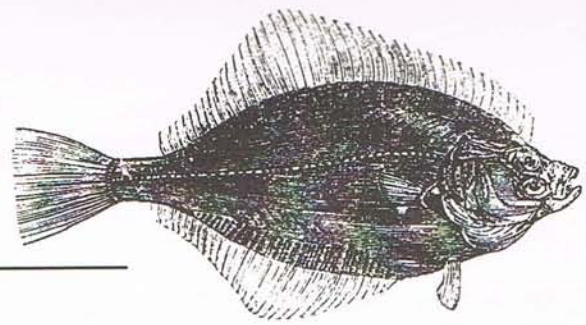
Public stewardship of the natural resources in the Casco Bay watershed will result in the protection of Casco Bay.

LACK OF PUBLIC AWARENESS

Maine people care about the environment and generally want to do the “right thing” to protect natural resources. What individuals can do to protect Casco Bay and the rivers, streams, lakes and wetlands in the Casco Bay watershed needs to be better defined. The Casco Bay Estuary Project plans to educate the public about actions that individuals can take to protect these natural resources. The ultimate goal is to encourage the residents of the Casco Bay watershed to feel a sense of public ownership of Casco Bay and the streams, rivers, lakes in the Casco Bay watershed.



ACTIVITIES IN PROGRESS



SEDIMENT CONTAMINATION

A comprehensive assessment of contaminant levels in the sediments in Casco Bay was conducted in 1991. Sediments were analyzed for contaminants at a total of 65 sites throughout Casco Bay. Petroleum hydrocarbons, metals, PCBs and pesticides such as DDT were measured. The results of the sediment contamination study will be presented in a separate document. The municipalities of Portland, South Portland and Falmouth shared the cost of the study with the Casco Bay Estuary Project. The results of the study will show the distribution of contaminants throughout Casco Bay and will be used by scientists to assess where core samples need to be taken to determine if the contamination is increasing, decreasing or staying the same.

A sediment contamination study will show the distribution of contaminants throughout Casco Bay.

DIRTY HISTORY

Many activities that may have a lingering environmental impact have occurred in Casco Bay, particularly in the Greater Portland area. The Casco Bay Estuary Project has funded an investigation of these historical activities in the Fore River watershed. As a result, current sources of pollution will be reviewed in combination with historic sources of pollution to provide a comprehensive assessment of possible sources of toxic pollution in the Fore River, the most developed part of the Casco Bay region.

A dirty history investigation will provide a comprehensive assessment of possible sources of toxic pollution.

CIRCULATION & FLUSHING RATES

A model of circulation in Casco Bay will be developed for the Casco Bay Estuary Project. Flushing rates in upper Casco Bay will be modeled, also. The flushing rate study is being conducted in response to concerns about nutrients and algae blooms in the upper bays (e.g., Maquoit and Middle Bays in Brunswick). The results of the broad scale circulation model will allow the direction of water flow to be predicted under varied tidal and wind conditions.

A circulation and flushing rates study will allow the flow of water in the Bay to be predicted under varied tidal and wind conditions.

REGULATORY & MANAGEMENT

An overview, summary and analysis of laws and agencies that regulate resources is being developed. In addition, long-term management alternatives for Casco Bay will be assessed by evaluating existing regional management entities in other parts of the country. The baseline information provided in this review will help the Casco Bay Estuary Project make recommendations for improvement of management to protect the water resources of Casco Bay and its watershed.

Baseline information will be provided in a review of the existing regulatory framework in Maine and an assessment of management alternatives.

NATIONAL ESTUARY PROGRAM REVIEW

Information about national implementation programs and other Maine water quality planning programs will be valuable to the Casco Bay Estuary Project.

A review and assessment was made of demonstration and implementation activities undertaken in other estuary programs for effectiveness, transferability and applicability to Casco Bay. In addition, a review and assessment was made of existing and past water quality planning programs in Maine for their applicability to the development of a management plan for the Casco Bay Estuary Project. Information about national implementation programs and other Maine water quality planning programs will be a valuable tool to assist in decision making by the Casco Bay Estuary Project.

VOLUNTEER MONITORING

Volunteer monitoring will result in an ongoing assessment of water quality and result in a large network of "bay watchers".

A volunteer monitoring program will be developed for the Casco Bay Estuary Project. Coordination for the volunteer monitoring program will be provided by Friends of Casco Bay. With the help of volunteers, numerous samples will be taken and analyzed. The results will be supplied to the Maine Department of Environmental Protection to help with the assessment and management of water quality. The results will become part of the data available on the computerized mapping system (GIS). By taking samples and making observations, volunteers will form a large network of "bay watchers" and will provide an ongoing assessment of water quality.

DATA MANAGEMENT / GEOGRAPHIC INFORMATION SYSTEM

GIS is a tool for storing and manipulating mapped information in a computer.

A geographic information system (or GIS) is a tool for storing and manipulating mapped information in a computer. The leading GIS program (ARC/INFO) is being used by the Casco Bay Estuary Project, the State of Maine and other New England states. All applicable data for the Casco Bay Estuary Project will be entered into the GIS.

Many GIS maps have been produced by the Casco Bay Estuary Project to date.

Through the use of GIS mapping, users are able to view and compare a wide variety of information. Basic information such as rivers, lakes, streams, town boundaries and roads is on the GIS system for the Casco Bay watershed. Other information is being added to the GIS system so that selected features can be viewed simultaneously. Shellfish beds, shellfish closures, Department of Marine Resources monitoring stations, seal haulouts and bird nesting and feeding areas are on the GIS for Casco Bay. Subtidal and intertidal sediments in Casco Bay are in the process of being entered into the GIS. Soils, CSOs (Combined Sewer Overflows), topography, landfills, salt and sand piles and leaking underground storage tanks are on the GIS for the Fore River watershed. Overboard discharge pipes and wetlands are on GIS for Harpswell and tax map property boundaries are on the GIS for Harpswell and Falmouth. A number of examples of GIS generated maps appear as illustrations in this report.

Towns are being encouraged to use GIS maps to help them illustrate information.

The town of Harpswell is using GIS for comprehensive planning.

Minigrants will allow local governments to help protect their water resources.

Public outreach activities will work towards developing public stewardship of the Bay and the water resources in the watershed.



Towns are learning about nonpoint source pollution and best management practices through a targeted technical assistance project.

The GIS being developed by the Casco Bay Estuary Project has user-friendly menus that can access the data, zoom in on selected locations and make map compositions by overlaying selected information. One goal is to display scientific data on easily understood maps.

The Casco Bay Estuary Project is helping the Town of Harpswell use GIS for comprehensive planning and management of their resources. The Harpswell town clerk and her assistant have spent many hours entering town data into the GIS. The town hopes that the GIS maps will assist the residents in making decisions about the future of Harpswell.

LOCAL GOVERNMENT

Minigrants will be available to local governments on a competitive basis for activities that protect water quality. Minigrants will allow local governments to help protect their water resources. A local government outreach strategy will be developed because the involvement by local governments is critical to the success of the Casco Bay Estuary Project.

PUBLIC OUTREACH

Public outreach activities include a quarterly newsletter, public forums, a slide show, fact sheets, posters and boat tours. Minigrants will be made available to local groups on a competitive basis for public participation and education activities. Outreach to schools will include slide shows and funding for Kids as Planners. The results of a constituent research project will be the basis of developing audience specific awareness projects. Public outreach activities will work towards developing a sense of public stewardship of Casco Bay and all the water resources in the watershed.

DEMONSTRATION PROJECTS

LOCAL GOVERNMENT • TECHNICAL ASSISTANCE

The Department of Economic and Community Development, Office of Community Development and the local regional planning commissions have been funded by the Casco Bay Estuary Project to provide technical assistance to towns in the lower Casco Bay watershed (downstream of the outlet of Sebago Lake). The purpose of the project is to introduce the towns to nonpoint source pollution and the use of best management practices to control nonpoint source pollution.

EXAMPLE OF GIS MAPPING CAPABILITIES

Harpswell

Stars are Overboard Discharges

Triangles are Department of Marine Resources Monitoring Stations

Red area is Closed by DMR for Shellfishing



PLEASANT RIVER

The Cumberland County Soil and Water Conservation District and Trout Unlimited have been funded by the Casco Bay Estuary Project to work on a riverbank restoration on the Pleasant River in Windham, Gray and Raymond. A riparian (riverbank) zone protection brochure has been written and distributed to sporting groups, farmers and landowners abutting the river. A riverbank planting day, educational workshops and video and a family festival are planned to make residents aware of the value of the river resource that the three towns share. Riverbank plantings will help control erosion along the Pleasant River.

A riverbank restoration project is underway on the Pleasant River in Windham, Gray and Raymond.

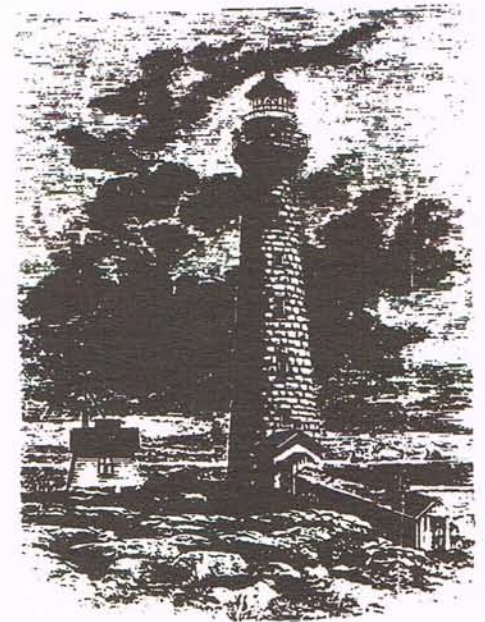
WHAT HAPPENS NEXT?

The Casco Bay Estuary Project is developing a preliminary management plan - the Comprehensive Conservation and Management Plan. This plan, due in the fall of 1992, will outline an overall strategy for the protection of Casco Bay. The priority issues of development, stormwater runoff and combined sewer overflows, septic systems and overboard discharges, pre-existing long term contaminants and lack of public awareness will be addressed in this management plan. The preliminary management plan will be used to set the agenda for research, demonstration projects and the development of implementation strategies. Implementation strategies will be analyzed as they are identified to see if it is feasible to take "action now".

A preliminary management plan -- the Comprehensive Conservation and Management Plan -- is going to be developed for the fall of 1992.

The preliminary management plan will set a framework for work to be completed for the final management plan, due in the fall of 1995. The final management plan will include specific proposals, institutional arrangements and financial plans to implement the protection strategy.

A final management plan is due the fall of 1995.



GLOSSARY

Algae bloom. A condition resulting from excessive nutrient levels or other physical and chemical conditions that enable algae to reproduce rapidly.

Anadromous fish. A species, such as salmon, alewives, smelt and shad, that is born in fresh water, spends a large part of its life in the sea, and returns to freshwater rivers and streams to mate and give birth (spawn).

Bioaccumulation. The process by which a contaminant accumulates in the tissues of an individual organism.

Combined Sewer Overflow (CSO). A pipe that, during storms, may discharge untreated sewage and stormwater. The overflow occurs because the sewage treatment plant does not have the capacity to treat the increased flow caused by stormwater runoff.

Eelgrass (*Zostera marina*). A marine flowering plant that grows on intertidal and shallow subtidal sand or mudflats.

Estuary. A semi-enclosed coastal body of water having free connection with the open sea and within which seawater is measurably diluted with fresh water.

Habitat. The specific area or environment in which a particular type of plant or animal lives. An organism's habitat must provide all the basic requirements for survival.

Impervious surface. A surface, such as pavement, that cannot be easily penetrated by water.

Nutrients. Essential chemicals needed by plants and animals for growth. Excessive amounts of nutrients can result in excessive growth of algae and lead to degradation of water quality. Nitrogen is generally the nutrient of concern in saltwater.

Overboard discharges. Discharges into a waterbody from overboard discharge units. These units were designed to treat wastes from households and small commercial operations such as restaurants. Overboard discharge units have mechanical or sand filter treatment followed by chlorination.

Metals (sometimes referred to as heavy metals). A group of elements found in rocks and minerals that are naturally released to the environment by erosion, as well as generated by human activities. Certain metals, such as mercury, lead, nickel, zinc and cadmium, are of environmental concern because they are released into the environment in excessive amounts by human activity and can produce toxic effects.

Petroleum hydrocarbons. The mixture of hydrocarbons normally found in petroleum (e.g. oils, gasoline); includes hundreds of chemical compounds.

PCBs (Polychlorinated biphenyls). A group of manufactured chemicals including about 70 different but closely related compounds made up of carbon, hydrogen and chlorine. If released to the environment, they persist for long periods of time and can bioaccumulate in organisms. PCBs are suspected of causing cancer in humans and their manufacture was banned in the late 1970s.

Pathogen. An agent such as a virus, bacterium or fungus that can cause diseases in humans.

Toxic. Poisonous, carcinogenic, or otherwise directly harmful to life.

Watershed. The geographic region within which water drains into a particular river, stream or body of water. A watershed includes hills, lowlands and the body of water into which the land drains. Watershed boundaries are defined by the ridges of land separating watersheds.

Casco Bay Estuary Project

FOR		CT:
BOB	Casco Bay Estuary Project	TOR
CAS	USM Room 408 Law School	
312	P.O. Box 9300	4103
TEL	Portland, Me. 04104	-4001



Printed on recycled paper