

HABITAT PROTECTION



CASCO BAY PLAN

To protect and restore habitat in Casco Bay, the Management Committee established the following goal and objectives:

GOAL:

Minimize adverse environmental impacts to ecological communities from the use and development of land and marine resources.

OBJECTIVES:

- No net loss of aquatic and island habitats.
- Habitats in Casco Bay should be of a quality that does not have an adverse effect on the structure and function of the biological community.
- The miles of rivers, streams, and coastal waters meeting water quality standards shall increase annually.
- The acreage of protected, regionally significant coastal habitat shall increase annually.

HABITAT PROTECTION

Introduction

To protect the wealth of species that live in Casco Bay, it is necessary to conserve the natural environment that provides their food, cover, travel corridors, and breeding and nursery areas. The habitats that support the bay's abundant plant and animal life range from forested wetlands and streams to eelgrass beds and muddy sea bottom.

Habitats are places where plants and animals live, feed, find shelter, and reproduce. The productivity of a habitat depends on how well the physical (e.g., temperature, salinity, and substrate) and biological (e.g., vegetative cover and food) requirements meet the needs of the species of plant or animal. For human members sharing natural habitats, the knowledge of interdependence carries with it a responsibility. To sustain the health of Casco Bay, we must pursue actions that benefit not only our own species, but also all the "neighboring" plants and animals that share the watershed's ecological community.



photo by Christopher Ayres

Species Diversity and Density

Casco Bay has long been recognized for its richness and diversity of wildlife. Collecting over 500 species from Casco Bay in 1874, the famous marine biologist A. E. Verrill noted the “great diversity in the character of the [bay’s] bottom and in the character of the fauna.” Much of that ecological diversity still exists today. *To date, at least 850 species have been identified in the waters of Casco Bay* (U.S. Fish and Wildlife Service, 1980). In 1980, a sample of just 1 square foot of Casco Bay mud yielded 86 different animal species (Larsen *et al.*, 1983).

The marine life in Casco Bay is rich in numbers as well as diversity. In the early 1900s, Dr. Kingsley, who located a biological laboratory in South Harpswell, wrote that “Casco Bay is nearly as rich in species as the southern coast [*i.e.*, Vineyard Sound, Massachusetts], while in individuals it is vastly richer, as has been noticed by everyone who has collected in the two regions.” *When compared to four similar water bodies around the world, Casco Bay illustrates its richness in numbers of living organisms* (Larsen *et al.*, 1983).

Mean Density of Organisms/Square Meter

Casco Bay	8,743
Gullmars Fjord, Sweden	4,198
Mystic River, Massachusetts	3,000
Lambert Bay, South Africa	1,153
Delaware Bay, Pennsylvania	722

The marine and coastal organisms found in Casco Bay include the following (Hutchinson and Ferrero, 1981; U.S. Fish and Wildlife Service, 1980; and Gilbert, 1995):

- 150 species of waterbirds, whose population reaches about 32,000 at peak times of the year
- 15,000 pairs of seabirds, including eiders, herring gulls, great black-backed gulls, double-crested cormorants, common terns, and black guillemots, which nest on approximately 50 islands in Casco Bay
- nesting sites of the endangered roseate tern
- hundreds of wintering loons and grebes
- 33 species of shorebirds, including thousands of migrating sandpipers, plovers, and related species
- six heron rookeries, including great blue herons, snowy egrets, glossy ibises, and black-crowned night herons
- one of the most important winter waterfowl populations along the Maine coast, including eiders, black ducks, and other waterfowl

- more than 50 pairs of nesting osprey, one pair of nesting bald eagles, and use by occasional peregrine falcons
- more than 2,000 harbor seals using approximately 40 ledges
- migrating whales, porpoises, and dolphins
- a wide variety of fish: flounder, skate, mackerel, haddock, cod, bluefish, striped bass, bluefin tuna, pollock, and others
- important commercial shellfish species, including lobster, clams, and scallops
- extensive and dense eelgrass beds

Prime Habitats

While Casco Bay provides habitat for all these species, each type of plant and animal tends to concentrate in particular sections of the bay and its watershed. Some ecological features — such as islands, tidal flats, and salt marshes — are especially important sources of food and shelter for numerous wildlife species.

The needs of plants and animals (their “habitat requirements”) may vary over their life span. For example, juvenile fish often inhabit the protected and rich waters of the bay’s estuaries, moving to deeper waters when they mature. Juveniles who, as a rule, usually are the most sensitive to habitat degradation have the most stringent habitat requirements.

The habitat requirements for adults remain relatively constant over time. For example, herons need tall shrubs or trees in which to nest and eelgrass beds require shallow clear water. The way a species uses a given set of resources, however, may change over time. Which rookeries herons use, or which mudflats they feed on, can vary depending on the availability of food, the existence of cover to lend protection from predators, and the population level of competitors.

This variability makes it difficult to define exactly which locations are most important and how much of these habitats must be protected. What is appropriate one year may be inadequate the next. *Environmental planning for habitat protection must therefore include a “margin of safety” to account for possible future needs.*

Priority habitats identified by the Casco Bay Estuary Project include the waters and islands of Casco Bay, and the rivers, streams, and freshwater wetlands of the watershed. While lakes, ponds, and certain terrestrial features provide important habitats, these are less directly linked to Casco Bay and therefore are not discussed in the *Plan*.

Marine and Estuarine Waters

The marine habitats of Casco Bay, which cover 229 square miles, can be separated into subtidal areas (those always under water) and intertidal areas (those

between extreme high and low tides that are periodically exposed to air).

Subtidal Areas. The composition of the sea bottom (*i.e.*, fine mud, sand, gravel, cobble, boulders, and rock) determines which plants and animals live in particular subtidal habitats. For example, lobsters, crabs, and sea urchins generally live on hard bottom, whereas scallops and worms dwell in soft-bottom areas.

Fish. Above the sea bottom, fish are an important user of the water of Casco Bay. *Thirty-six species of finfish reside in Casco Bay, with winter flounder being the most common species found year-round.* The most abundant year-round fish in the bay are bottom feeders such as pollock, sculpin, and skate. These fish feed on the diverse and plentiful supply of marine invertebrates, including small bottom-dwelling mollusks, marine worms, and shrimp-like animals. The shallow protected coves in Casco Bay provide perfect spawning habitat for fish that deposit eggs on the bottom (*e.g.*, sculpin, winter flounder, rock gunnel, tomcod, and skate) (U.S. Fish and Wildlife Service, 1980).

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 enter the bay in summer; alewife, rainbow smelt, shad, and occasional salmon pass through Casco Bay on their way to spawn in rivers. Eels live in the rivers of the watershed and travel through Casco Bay to spawn in the Sargasso Sea.

Waterbirds. Waterbirds also use the open waters of Casco Bay. Cape Elizabeth in Casco Bay is the boundary for two zoogeographic regions — the boreal and northern temperate zones — for waterbirds (*i.e.*, seabirds, shorebirds, wading birds, and waterfowl). Consequently, a wide variety and unusual aggregation of marine birds occur in Casco Bay. *Approximately 150 species of waterbirds inhabit Casco Bay, 100 of which occur regularly.* The number of waterbirds in Casco Bay varies seasonally from approximately 4,600 to about 32,000. There are three peaks: in October during fall migration, during January when the majority of birds (primarily waterfowl) are wintering in Casco Bay, and in February and March during spring migration. These birds use the bay's open waters for feeding, molting, migrating, and wintering. The endangered least tern and piping plover nest on beaches north and south of Casco Bay and use the bay for feeding (Hutchinson and Ferraro, 1981; and U.S. Fish and Wildlife Service, 1980).

Casco Bay supports important winter waterfowl populations. Eiders, black ducks, mallards, goldeneyes, buffleheads, scaups, scoters, old squaws, megansers, brant, green-winged teal, and Canada geese are common in the bay. Loons and grebes also winter in Casco Bay, with the horned grebe and common loon being the most common species. Large numbers of eiders, scoters, goldeneyes, black ducks, and buffleheads winter in Casco Bay. For example, Back Cove in Portland is an important winter feeding area for black ducks and mallards. Several raptors, including osprey and the endangered bald eagle,

use open water areas for feeding.

Marine Mammals. The harbor seal is the most common species found in the waters of Casco Bay, with occasional sightings of gray seals as well. Whales migrate through the waters off Casco Bay. Sightings in the Casco Bay area include the endangered humpback whale, the killer whale, the beluga, and the sperm whale. Harbor porpoises can be seen during the summer, and the common dolphin and striped dolphin occasionally enter Casco Bay. Seals and whales use the subtidal waters for feeding.

Plants. Plants, which support the food chain, are an important part of subtidal habitats. One particularly sensitive plant, eelgrass, is considered an indicator of ecosystem health. Growing in shallow, clear water with silty sand bottoms (and on some flats), it is used by flounder, cod, striped bass, scallops, crabs, lobsters, and waterfowl as a nursery area, feeding ground, or refuge from predators. Casco Bay has the largest and most dense concentrations of eelgrass mapped along the coast of Maine, with over 7,000 acres of beds.

Intertidal Areas. The intertidal zone of marine estuarine waters includes a diverse array of habitats from rocky shore to salt marshes and flats. Due to topography and wide tidal variations characteristic of the Gulf of Maine, intertidal areas in Maine are the most extensive along the Atlantic Coast of the United States.

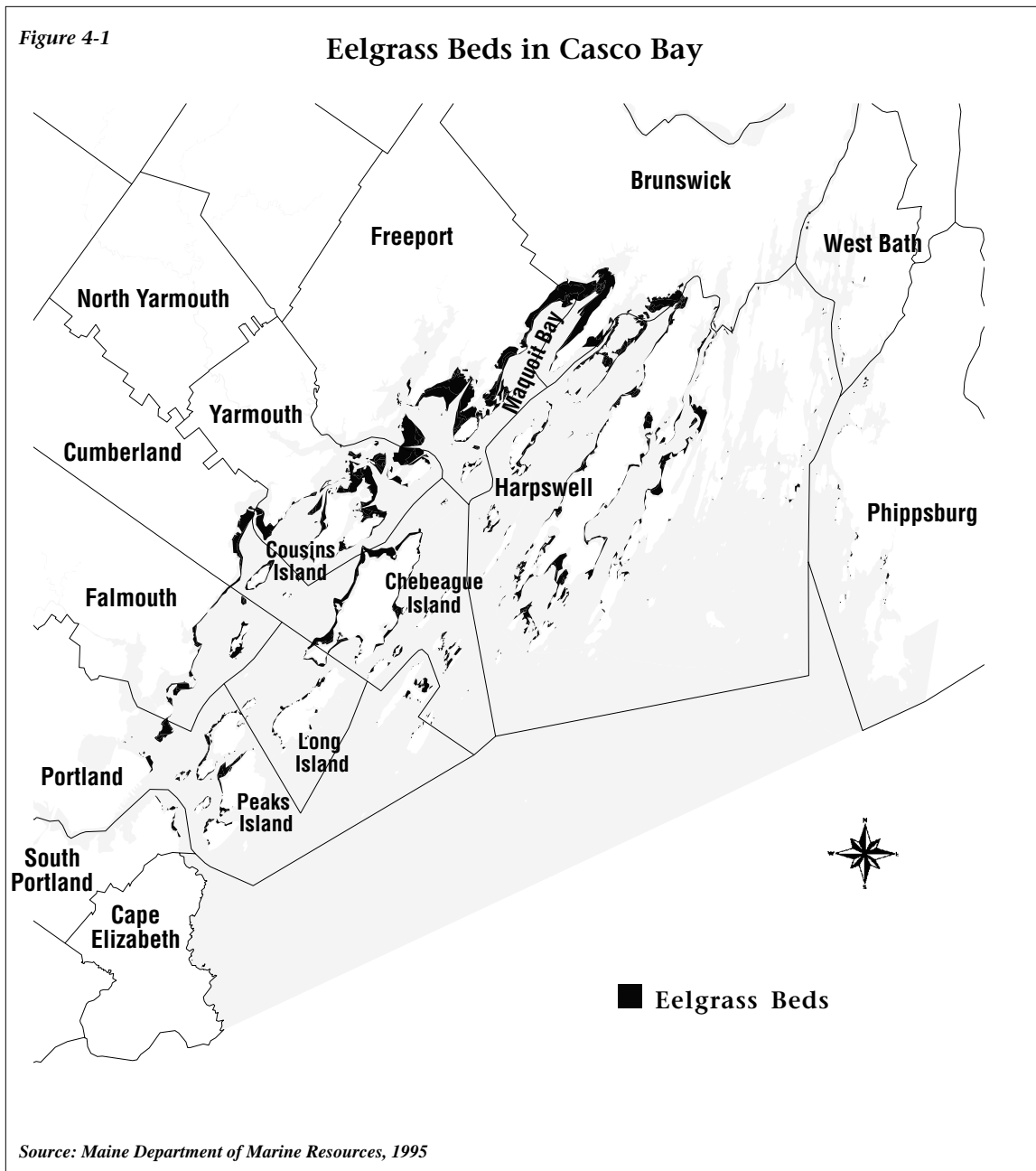
Salt marshes are highly productive ecosystems that contain cordgrass, salt hay, and spikegrass. Salt marshes provide essential habitat to mussels and other mollusks, herons, mallards, black ducks, muskrat and other fur-bearing mammals, silversides, sticklebacks, mummichogs, and worms.

Salt Marshes. 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.

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

Flats. *Flats are the most characteristic intertidal habitat in Casco Bay*, with 11,582 acres of tidal flats. Flats form in relatively sheltered bays and are principally mud or sand. Flats are especially important environments because they support a rich and abundant 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 (amphipods). The flats in the Brunswick and Harpswell area also have southern species, such as quahogs, that are completely isolated from their counterparts in southern New England.

Shorebirds, waterfowl, and wading birds feed on flats and in the creeks and shallow subtidal areas near flats. Thirty-three species of shorebirds are common along the Maine coast. As many as 300,000 semipalmated sandpipers,



which is approximately 10 percent of their total population, migrate along the coast of Maine in spring and early fall. Tens of thousands of migrating semipalmated plovers, short-billed dowitchers, black-bellied plovers, and ruddy turnstones also use the Maine coast.

There are numerous areas in Casco Bay used by hundreds of shorebirds and several locations where relatively large numbers of migrating shorebirds congregate to feed seasonally, such as the Fore River Estuary, Back Cove, and Maquoit and Middle bays in Brunswick. A popular feeding area is Back Cove, where up to 5,000 shorebirds, including semipalmated plovers, black-bellied plovers, ruddy turnstones, yellowlegs, least sandpipers, dunlins, short-billed dowitchers, and semipalmated sandpipers, congregate to feed.

Rocky Shore. The 500 acres of rocky shore in Casco Bay provide habitat for a wide range of species, from seaweeds, periwinkles, mussels, barnacles, and crabs to starfish and seals. Some areas are exposed to the force of wind and waves, which impacts the species that can be supported. In and around tide pool areas are lumpfish, sticklebacks, sea snails, winter flounder, and pollock, as well as sandpipers, ruddy turnstones, and sanderlings. Waterfowl such as eider ducks use rocky shore habitat for feeding.

Islands. *Casco Bay contains 758 islands, islets, and exposed ledges at mean high tide, a few of which are important habitat for colonial nesting seabirds (e.g., the common eider, double-crested cormorant, herring gull, great black-backed gulls, and common and roseate terns).* Uninhabited outer islands often provide prime nesting sites for seabirds, being inaccessible to predators such as fox, mink, and raccoons.

The bay has 50 seabird nesting islands, of which 17 support nationally significant populations of nesting birds (defined by U.S. Fish and Wildlife biologists as greater than 1 percent of a species population in Maine). The 17 major nesting colonies are inhabited by approximately 15,000 nesting pairs of eiders, herring gulls, great black-backed gulls, and black guillemots, which collectively represent more than 15 percent of the state's nesting seabird population.

The numbers of common terns are reduced today in Casco Bay because they are out-competed for food and nesting space and preyed upon by great black-backed and herring gulls. A recently enacted tern restoration program devised by the National Audubon Society and Maine Audubon Society at Jenny Island in Casco Bay helped revitalize that colony of common terns from 59 pair in 1991 to 500 pair in 1995.

Large numbers of great blue herons and lesser numbers of black-crowned night herons, glossy ibises, and snowy egrets nest on several islands in Casco Bay.

Ledges and bars associated with the outer islands provide important ice-free wintering areas for black ducks, eiders, scoters, and old squaws. Migratory brant use these areas in the spring. Landbirds, shorebirds, and geese also use islands during migration.



photo by Christopher Ayres

Until the 1960s, the endangered bald eagle nested in Casco Bay. Absent for years, two nesting pairs recently returned to Casco Bay. *More than 50 pairs of osprey nest in Casco Bay, principally in the eastern part of the bay.* The endangered peregrine falcon occasionally uses Casco Bay during migration.

There are 41 documented seal haulouts in Casco Bay, on either small islands with no terrestrial vegetation or half-tide ledges that are under water at high tide (Gilbert, 1995).

Rivers, Streams, and Freshwater Wetlands. Casco Bay is fed by four rivers (the Presumpscot, Royal, Stroudwater, and Fore) and a vast network of streams that flows into these rivers or directly into Casco Bay. *Throughout the Casco Bay watershed, there are more than 1,356 miles of rivers and streams that offer habitat to muskrat, beaver, river otter, belted kingfisher, black duck, spotted sandpiper, shad, trout, bass, perch, pickerel, and salmon.* Streams provide important habitats for juvenile fish and for anadromous fish like alewife and smelt, which use them for spawning. The landlocked salmon, a prized recreational fish, lives in Sebago Lake and spawns in the upper Casco Bay watershed.

The riparian (i.e., streambank) zone and the 578 miles of edge habitat next 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.

Freshwater wetlands (*i.e.*, vegetated wetlands that often fringe open water but also can be isolated from surface water bodies) range from marshes and wooded swamps to vernal pools (*i.e.*, wetlands that hold standing water for several months in spring and early summer and provide important breeding sites for amphibians). Like coastal salt marshes, freshwater wetlands afford critical habitat, particularly for deer, beavers, muskrats, raccoons, wood ducks, American bitterns, great blue herons, green herons, leopard frogs, painted turtles, and four-toed salamanders. Freshwater wetlands also play an important role in purifying polluted water and reducing flood damage.

Habitat Threats

Human activity can threaten habitat in numerous ways, through direct loss, fragmentation, encroachment, disturbance, diminished water quality, altered drainage patterns, and barriers.

Who Needs Large Habitat Areas?

Large habitat areas are needed by certain species, such as red-shouldered hawk, which require up to 620 acres of upland and wetland forest for breeding, and the American bittern, which requires a minimum of 6 to 12 acres of shallow freshwater wetlands where abundant vegetation is interspersed with patches of open water (Eaton *et al.*, 1914; Gibbs *et al.*, in press).

Direct Loss

Construction of buildings or parking lots causes fragmentation and loss of natural habitats. Although building projects may appear small and losses minimal, their cumulative effect can be significant. In marine environments, subtidal dredging of navigation channels, piers, and marinas can diminish or destroy habitat.

Fragmentation

Many animals and plants require large tracts of habitat to meet their own needs or to serve as a buffer from human activities. Development can fragment natural areas, disrupting important travel corridors and increasing mortality rates by making it easier for predators to reach species that inhabit the interior of undisturbed areas.

Encroachment

Activities adjacent to a habitat may make it unusable. All habitats need buffers (the size and type of buffer depends on the species); impacts like water quality changes, human disturbance, and increased predator activities can reduce or eliminate a habitat for some species.

Disturbance

Some wildlife cannot tolerate any human disturbance and will, for this reason, abandon otherwise suitable habitat. Even minimal recreational activity, such as walking on islands during nesting season or noise from boats, can affect some species.

Metal drags used to harvest groundfish, mussels, sea urchins, and scallops turn over the surface layer of sediments, disrupting the community of plants and animals that lives there. Other organisms that share the soft-bottomed habitat, such as eelgrass and large burrowing worms, can be completely removed.

Diminished Water Quality

Direct or nonpoint discharges of pollution can increase water temperatures, degrade water quality, create turbid conditions, change currents, or alter salinity — any of which can make the area unsuitable for native species.

Altered Drainage Patterns

Buildings and pavement prevent water from seeping into the ground; storm drains channel water from a wide area to one location; and pipes and culverts can move water from one sub-watershed to another. Such changes can cause flooding, reduce groundwater discharge, change stream flows, increase water temperatures, alter salinity, and increase erosion — all of which degrade habitats.

Barriers

Human-made structures such as roads, driveways, and bridges often create barriers for plants and animals. Culverts can obstruct the passage of fish and restrict the flow of salt water to upstream marshes. Dams prevent fish from migrating upstream, reduce downstream flows, raise water temperatures, reduce dissolved oxygen levels, and accumulate toxic sediments, making the river unsuitable for some species.

Seawalls built to prevent erosion represent another type of barrier. Due to subsidence of the earth's crust, the sea level in Casco Bay has risen almost a foot this century and continues to rise. When property owners construct seawalls to hold back the water, they sacrifice intertidal lands, which get squeezed out

Birds That Need Privacy

In Casco Bay, the bird species most susceptible to human disturbance during critical seasons are bald eagles, great blue herons, common eiders, common least, roseate terns, and piping plovers. Migratory shorebirds and other wading birds are also easily disturbed from their layover/feeding sites. Disturbances reduce feeding times that are already limited by tides, which can cause birds to abandon a preferred site for a less advantageous one.

between the sea and a stone or riprap wall.

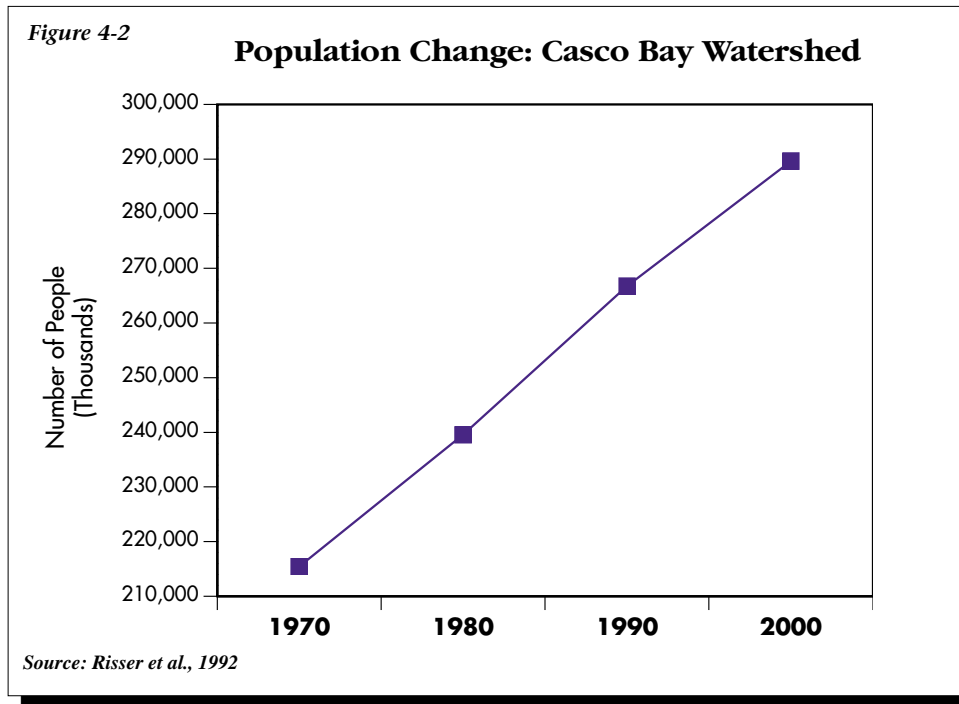
Habitat Degradation

Evidence of damaged habitats can be found throughout Casco Bay and its watershed:

- The New Meadows “Lake” north of Route 1, once a tidal estuary, now suffers from algal blooms due to limited tidal flushing caused by the restrictive spillway.
- Long Creek, near the Jetport in Portland, has degraded wetland areas resulting from the construction of Interstate 295.
- Interstate 295 crossing over the Presumpscot River has impaired the natural tidal flushing and allowed the buildup of sawdust and paper mill waste.
- Four dams on the main stem of the Royal River present barriers to fish, as none have fish ladders.
- Capisic Brook in Portland used to be an American eel run but is now impassable due to a dam and reduced water flows caused by sewerage in the area, which redirected some water flows to sewers.

Populations and Housing Trends

Damage to natural habitat has accelerated due to an increase in human population and housing development. *Population in the lower Casco Bay watershed increased by 51,000 people (almost 24 percent) between 1970 and 1990, bringing*

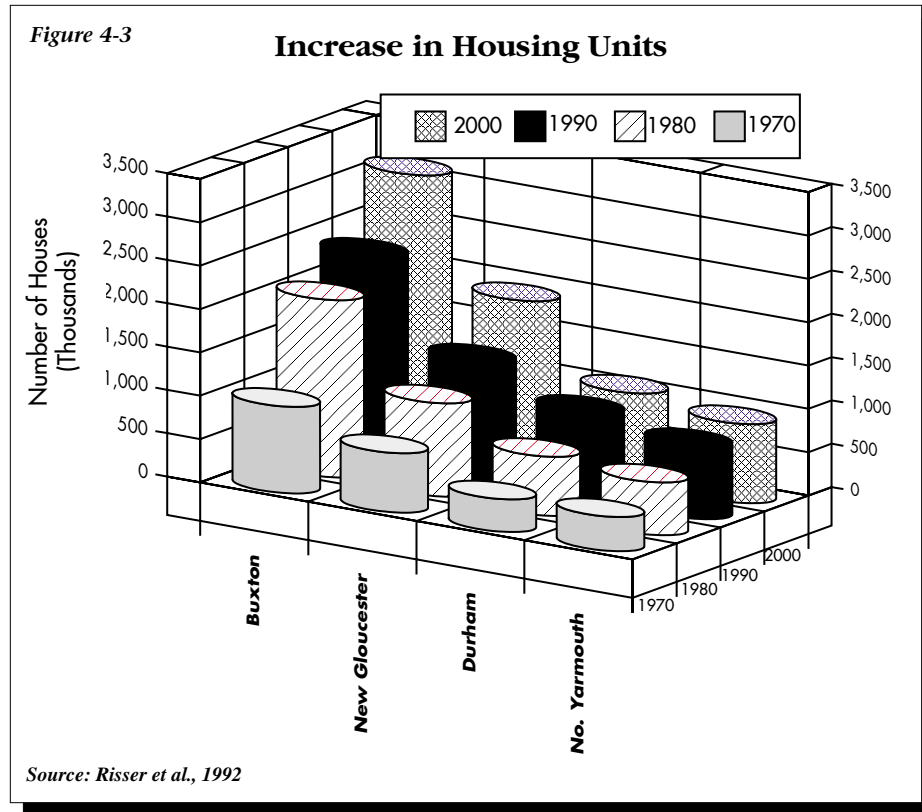


the total to almost 270,000. Although growth has slowed in recent years, the area is projected to have 290,000 people by the year 2000 (Risser et al., 1992) (see Figure 4-2).

The impact of population growth is accentuated by the geographic dispersal of people in the watershed. *The more dispersed housing is, the greater the fragmentation of habitat and loss of critical species. From 1970 to 1990, the number of housing units in the Casco Bay watershed increased by almost half — twice the rate of population, with most of the growth suburban and rural. Small towns in the lower watershed grew the most between 1970 and 1990. Durham more than doubled its housing units, growing 164 percent; Buxton grew 136 percent, North Yarmouth 111 percent, and New Gloucester 99 percent (see Figure 4-3).*

As the number of people living in each household declines, more houses are required to shelter the population. And as people move out from urban to rural areas, new growth disturbs more plant and animal communities. A review of comprehensive plans completed by Casco Bay communities indicates a widespread concern over this dispersal of housing. Increased population pressures are also evident on the islands of Casco Bay. *Annual ridership on the Casco Bay Ferry Lines rose from approximately 360,000 people in 1972 to more than 760,000 in 1994 (Christian, 1995).*

The population of Portland and South Portland dropped from 88,383 in



1970 to 84,284 in 1980. During the same decade, the watershed population increased by over 24,000 people. These figures reflect the “suburbanization” of the Portland area.

Ecological Impacts

The combined effect of development and pollution has caused damage to Casco Bay habitats. In 1994, for example, the U.S. Fish and Wildlife Service documented that 228 acres of vegetated wetlands were lost between the mid-1970s and mid-1980s in coastal areas from Prouts Neck to Merrymeeting Bay (Foulis and Tiner, 1994). Some of these areas are outside Casco Bay.

While this figure represents a small percentage of

CAUSE OF WETLAND LOSS	ACRES LOST
Commercial development	95.12
Housing	43.53
Sand and gravel pits	10.78
Road construction	10.49
Agriculture	8.35
Timber harvest	7.80
Unknown	5.55
Public facilities (federal land)	4.43
Trailer parks	2.91
Construction of pond dams	2.48
Industrial development	0.81
Channelization	0.63

the watershed's total wetlands, the loss did not include further losses during rapid growth of the late 1980s, or losses of "linear fringe wetlands" that surround narrow streams. Documented causes of the loss are cited as follows:

Beyond the direct loss of habitats, there is the more widespread threat of habitat encroachment that was clearly documented in a 1987 study of cumulative impacts from development in Scarborough and four other coastal Maine towns. This study found that while direct wetland loss was minimal, there were high rates of loss in areas surrounding wetlands (Arbuckle and Lee, 1987). *Human encroachment in nearby uplands can diminish wetland quality through agricultural runoff, stormwater runoff, groundwater withdrawals, and increased water pollution.*

Wetlands are the only habitat type that have been carefully studied for changes over time. However, the cumulative degradation of wetlands is occurring in all the priority habitats: islands, rivers and streams, and marine waters.

Loss of habitat leads to declines in species populations, a trend evident around Casco Bay (Doggett, 1995; Libby and Banner, 1995; Larsen *et al.*, 1983; and U.S. Fish and Wildlife Service, 1980):

- Terns, which have historically nested on several islands in Casco Bay, now nest only on Jenny Island. While the island supports a productive population, the colony is vulnerable because all nests are concentrated in one location.
- A sediment sample in the Fore River found only two animals per square foot, compared to an average of 874 animals per square foot in other parts of the bay.
- Rainbow smelt used to spawn in the Presumpscot River, but dams now block their use of the river.
- Alewives, anadromous fish that spawn in freshwater rivers and streams and provide an important food source for other species, have declined drastically.
- Quahogs and American oysters, found in Back Cove and the Fore River by A. E. Verrill in 1874, are gone due in part to high levels of contamination.

Casco Bay's Endangered and Threatened Species

Currently, 22 animal species are listed as endangered or threatened under Maine's endangered species law. Of these, the bald eagle and roseate tern nest in Casco Bay, and peregrine falcons use the area during migration. The watershed of Casco Bay is in the habitat range for the endangered sedge wren and black racer (snake) and the threatened Blanding's turtle. The threatened spotted turtle has been found in the watershed (Hunter *et al.*, 1992). An expanded list of endangered and threatened species is being considered for protection by the State of Maine.

- Black ducks wintering in Casco Bay have shown an overall decline.
- Atlantic salmon have declined due to over-fishing and habitat destruction.

Identification of Important and Potentially Threatened Habitats

A comprehensive study identifying important fish and wildlife habitat in Casco Bay and 15 adjoining towns was completed for the Casco Bay Estuary Project in 1996. Using data from Maine Department of Inland Fisheries and Wildlife, Maine Department of Marine Resources, Maine Office of Geographic Information Systems, Maine Audubon Society, National Wetland Inventory, and LANDSAT satellite imagery, biologists from the U.S. Fish and Wildlife Service's Gulf of Maine Project mapped the distribution of habitats for waterbirds, seabirds, wading birds, fish, eelgrass, cordgrass, marine worms, shellfish, and endangered threatened species.

Additionally, U.S. Fish and Wildlife Service biologists and the Casco Bay Estuary Project examined a related but more specific question: "What would happen to existing habitats if the towns surrounding Casco Bay developed to the extent currently permitted?" By relating potential land use with the existing habitat, U.S. Fish and Wildlife Service biologists identified key fish and wildlife habitats that may be threatened. This information will help individuals and organizations focus voluntary, locally initiated protection efforts toward those areas most likely to be impacted by development.

Economic Value of Habitat

Although their full worth cannot be quantified, the species and ecosystems of Casco Bay provide a valuable economic resource for the region. The dollar value assessed in transactions when habitats are bought and sold as real estate does not include the broader ecological values of habitat (*e.g.*, supporting wildlife, filtering surface and groundwater, and providing open space and flood control).

Some economic indicators, such as the fisheries industry, do reflect the health of the ecosystem. Research done by the University of Southern Maine estimated the value of the fisheries industry to Casco Bay at \$120 million (Colgan and Lake, 1988). A study done for the Casco Bay Estuary Project estimated that *the direct "in-flat" value of the soft-shell clam industry in 1994 was \$4.66 million, with an overall impact between \$11.6 and \$15.7 million — providing full or partial employment for almost 300 people, including commercial license holders and shellfish dealer employees (while an additional 1,252 people held recreational shellfish licenses) (Heinig et al., 1995).*

A second direct measure of economic value can be found in tourism and recreation. The 1988 University of Southern Maine study estimated that tourism

Figure 4-4

Important Habitats for all Evaluation Species (Lower 15 Towns in Casco Bay Watershed)

and recreation in Casco Bay generated \$250 million a year. While the success of these industries cannot be directly attributed to the living resources of the bay, the region's natural assets are clearly an integral part of what makes it a popular destination.

A statewide study done in 1990 on the impact of game and nongame species also documented the value of wildlife. It was estimated that \$121 million to \$260 million was spent by residents and non-residents to fish recreationally in Maine's marine waters. The report estimated that an additional \$158 million to \$351 million was spent on freshwater recreational fishing in 1988. Although these numbers are not confined to the Casco Bay region, they do reflect the economic importance of wildlife to Maine.

The value of living resources is also evident in the higher value placed on waterfront property. The University of Southern Maine study (1988) found that waterfront property was worth 100 to 400 percent more than similar property not located on the water.

Other studies show that the cost of habitat protection is far less than restoration of damaged habitats. Based on preliminary analysis of several recent projects, the Maine Department of Transportation found the cost range for creation of new wetlands from \$54,766 to \$504,736 per acre of impact, with an average of \$214,000 per acre. The cost for preservation is \$30,538 to \$1,055,112 per acre of impact, with an average of \$151,000.

While these economic indicators give some measure of the value of habitat, they cannot capture many of the intrinsic values of the ecosystem or the non-monetary benefits it provides to residents of the watershed in terms of aesthetic appreciation, sense of place, and leaving a legacy for future generations.

Regulatory and Other Protective Measures

Wetlands Regulation

Casco Bay and the rivers, streams, and freshwater wetlands of the watershed are treated as waters under both federal and state law. At the federal level, the U.S. Army Corps of Engineers issues permits under Section 404 of the Clean Water Act for discharges of dredged and fill material into wetlands and other waters, and under the Rivers and Harbors Act for dredging activities and the placement of structures in traditionally navigable waters of the United States. Most activities are covered by a State Program General Permit (SPGP) issued by the Army Corps of Engineers on October 1, 1995. The nationwide permits that were in effect in Maine are now replaced by the SPGP, with the intended result of streamlining the permitting process while increasing environmental protection. The SPGP sets thresholds for projects, specifies the type of review they

must receive (based on the size of the impact), and requires certain standards to be followed. For projects requiring an individual Section 404 permit by the Army Corps, Maine has the authority, under Section 401 of the Clean Water Act, to deny, grant, or condition certification of the Section 404 permit, to ensure that the permit satisfies the water quality requirements of state law.

As of September 29, 1995, Maine's Natural Resource Protection Act (38 MSRA 480-W) was amended to make it more consistent with the federal wetlands regulatory program (described previously). Major points of the new law include:

- A requirement for permits for any activity that affects floodplain wetlands, coastal wetlands, and freshwater wetlands regardless of size. There is no longer a 10-acre-size threshold for freshwater wetlands. The level of review required is now based on the size of the alteration in the wetland rather than the size of the wetland.
- A tiered review process. The review time is dependent on the size of the wetland impact and the level of alteration of significant wetland functions.
- A definition of projects that might affect significant wetland functions.
- Exemptions for *some* minor projects, activities adjacent to freshwater wetlands, forest management, and agricultural activities.
- Significant vernal pools are now included as significant wildlife habitat.

As a result of these revisions, "one-stop permitting" is now in place for most wetland alteration projects. A joint application form is filed by applicants. The Maine Department of Environmental Protection coordinates with federal agencies on screening and reviewing applications.

A State Wetland Conservation Plan is being prepared by the Maine State Planning Office through funding provided by the U.S. Environmental Protection Agency. The goals of the plan are to:

- improve the effectiveness and efficiency of governmental wetlands regulation programs
- protect, restore, and create wetlands
- provide an opportunity for the participants to speak with one voice on critical policy issues

Through the Conservation Plan Task Force and five technical work groups, consistent policies and priorities for wetland management will be developed with recommendations for implementation. When the plan is implemented, Maine will inventory and protect its most valuable wetlands, while creating a streamlined, predictable process to permit impacts on wetlands with lower value.

Maine's Mandatory Shoreland Zoning Act protects areas adjacent to some

wetlands and streams by requiring that towns establish resource protection districts for certain sensitive areas, including wetlands rated by the Maine Department of Inland Fisheries and Wildlife as having moderate or high value for waterfowl, and land areas along rivers subject to severe bank erosion. The law also requires protection districts to be established around certain streams, and encourages protection districts around other important wildlife areas in municipalities.

Habitat Regulation

The Natural Resource Protection Act also protects “significant wildlife habitats.” Defined by the species that use them, these areas include habitats of threatened or endangered species; high and moderate value deer-wintering areas and travel corridors; high and moderate value waterfowl and wading bird habitats; critical spawning and nursery areas for Atlantic sea-run salmon; shore-bird nesting, feeding, and staging areas; and seabird nesting islands.

Under the law, these areas must be mapped by the Maine Department of Inland Fisheries and Wildlife and the maps taken through rule-making by the Maine Department of Environmental Protection before the protection of the law applies. Subsequent activities occurring in, on, or over these areas must receive a permit from the Maine Department of Environmental Protection. Since the law was passed in 1988, the Maine Department of Inland Fisheries and Wildlife has produced maps for seabird nesting islands (of which 59 are in Casco Bay), and the Maine Department of Environmental Protection has begun the formal rule-making process. The Maine Department of Inland Fisheries and Wildlife is completing additional maps for deer-wintering areas and habitat for inland waterfowl and wading birds.

The Maine Endangered Species Act also provides for habitat protection, allowing the Maine Department of Inland Fisheries and Wildlife to designate “essential habitats” for threatened and endangered species if habitat is a limiting factor restricting their population growth. Activities occurring within these areas are then reviewed by the Maine Department of Inland Fisheries and Wildlife. The Department has mapped essential habitats for bald eagles, roseate and least terns, and piping plovers. Essential habitat for bald eagles and roseate terns occurs in Casco Bay.

Species Regulation

Threatened and endangered species are protected under the Maine Endangered Species Act and the Federal Endangered Species Act. The federal law protects listed species from activities such as takings, harassment, harming, capturing, and collection, while the state law prohibits the export, hunting, trapping, possessing, or selling of threatened or endangered species.

The federal Marine Mammal Protection Act imposes a moratorium on the taking and importation of all marine mammals and marine mammal products, and regu-

lates incidental taking of mammals during commercial fishing activities.

The Commissioner of the Maine Department of Marine Resources also has the authority to close certain portions of in-state waters to fishing activities for conservation and propagation purposes. Statewide, conservation areas are currently in effect for clams, quahogs, mussels, oysters, marine worms, and lobsters; however, none of these occur in Casco Bay.

Regulatory Limits

While providing important protection for many Casco Bay habitats, the existing laws have several notable gaps and weaknesses:

- *They fail to address activities adjacent to designated habitats that diminish habitat value.* Shoreland zoning only applies to specified areas (e.g., streams below the first branch shown on U.S. Geological Survey topographic maps), leaving many streams unprotected. In the Royal River watershed, for example, only 46 percent of the waterways are protected under the Shoreland Zoning Act (Sowles, 1991).
- *Only a few of the “significant wildlife habitats” specified in the Natural Resources Protection Act are being formally regulated to date.* The process of gathering reliable habitat data, developing criteria for determining “significant” habitats, and developing land use standards is time-consuming. Limited resources at the Maine Department of Inland Fisheries and Wildlife may prevent additional areas from receiving protection in the near future.
- *Because the Natural Resources Protection Act focuses on habitats of statewide significance, certain local habitats that are an important town resource may not be mapped by the Maine Department of Inland Fisheries and Wildlife.*
- *The Natural Resources Protection Act does not effectively address cumulative impacts (and there are few known examples of laws that do adequately address this concern).* Many minor influences that seem innocuous when viewed in isolation can have major impacts when taken as a whole.
- *Municipal officials routinely make decisions that affect habitat when administering their shoreland zoning ordinance or deciding to grant variances, yet those involved often lack the information and expertise needed to identify and protect important habitat areas.* While the Maine Department of Inland Fisheries and Wildlife provides habitat maps, and both the Maine Department of Inland Fisheries and Wildlife and the Maine Department of Marine Resources staff respond to inquiries from towns, this information is often solicited in reaction to a specific project, rather than in a proactive manner.

- The Maine Endangered Species Act neglects coverage of rare and endangered plant species. The Maine Natural Areas Program tracks data on rare plants (and other significant natural features) but has no regulatory authority.
- Property tax rates can strongly influence decisions made by property owners concerning the future of undeveloped lands. *Under the current tax structure, some landowners cannot afford to keep land undeveloped and preserve its maximum habitat value.*

Voluntary Conservation

An important complement to regulations are voluntary partnership activities designed to protect habitat. Private organizations, working with federal and state agencies, pool their collective capabilities in biological expertise, funding, and local knowledge to protect habitat.

Land Trusts — A Complement to Regulations

Twenty nonprofit conservation land trusts now operate in the Casco Bay watershed. Their efforts are supplemented by statewide groups such as The Nature Conservancy, Maine Audubon Society, Maine Coast Heritage Trust, Small Woodland Owner's Association, Maine Department of Inland Fisheries and Wildlife, and federal agencies such as U.S. Fish and Wildlife Service's Gulf of Maine Project. They all pursue voluntary conservation, working with private landowners, municipalities, and each other to permanently protect and manage land for the public benefit.

The Casco Bay region has some outstanding examples of voluntary land conservation:

- Portland Trails led a successful campaign to establish the Eastern Promenade Shoreway Trail, a critical segment of its proposed 30-mile trail network in and around Portland.
- Brunswick/Topsham Land Trust recently completed public trails for hiking and skiing on a private waterfront farm in Topsham, where a conservation easement fosters traditional public uses.
- Phippsburg Land Trust recently raised \$200,000 to buy Center Pond, a local landmark, and the surrounding 250 acres.

Voluntary habitat protection involves the collaborative efforts of willing landowners, private citizens, local land trusts, Maine Coast Heritage Trust, The Nature Conservancy, Maine Department of Inland Fisheries and Wildlife, U.S. Fish and Wildlife Service's Gulf of Maine Project, and other local, state, and national groups that protect habitat through the donation or purchase of land and conservation easements. Local, state, and federal governments also pursue proactive conservation through the purchase and maintenance of open space, parks, wildlife refuges, and wildlife management areas and by providing biological expertise and funding to other organizations with similar objectives.

Tax Code

The state tax code can affect the ability of private landowners to protect habitat. If the tax burden on undeveloped habitat areas is too high, landowners may be forced to subdivide or sell their land. To alleviate this pressure, Maine has instituted two tax-relief measures: the tree growth and open space tax laws. While not designed specifically for habitat protection, these measures often protect areas that include valuable habitat.

Recommendations

Protecting habitat for the wealth of species that live in Casco Bay is a critical concern as land development continues throughout the watershed.

The following list of actions outlines some measures that will begin to address habitat protection and restoration. The title of each action is listed below. Following the title is the action number. The actions are described more fully in Chapter 7. Actions that directly relate to this chapter appear in bold typeface; other actions that support this chapter appear in regular typeface.

■ Public Education

- Fund high school students' research. (#1)
- Focus post-secondary educational programs on Casco Bay. (#2)
- Conduct a comprehensive campaign to promote sound household practices. (#3)
- **Educate boaters about low-impact practices, non-toxic boat products, and the need to protect sensitive habitats. (#4)**
- Develop an environmental habitat kit and guide maps to Casco Bay for the general public. (#5)
- Hold "State of the Bay" conferences. (#7)

■ Technical Assistance

- **Provide technical assistance necessary for habitat protection. (#7)**

■ Regulatory/Enforcement Plan

- **Clarify use of the Natural Resource Protection Act for habitat protection. (#1)**
- Adopt minimum standards for stormwater quality in state and municipal regulatory programs. (#3)

■ Planning and Assessment

- Develop a comprehensive management strategy for dredged material. (#2)
- Research the impact of tax codes on habitat conservation. (#4)
- **Develop a plan to restore degraded habitats in Casco Bay. (#5)**
- **Develop a grant program to support local habitat protection activities. (#8)**