Commonwealth of Massachusetts
Mitt Romney, Governor ◆ Kerry Healey, Lieutenant Governor

Executive Office of Environmental Affairs
Ellen Roy Herzfelder, Secretary

Massachusetts Office of Coastal Zone Management
Tom Skinner, Director

Executive Office of Environmental Affairs

Massachusetts Office of Coastal Zone Management

National Oceanic and Atmospheric Administration

Massachusetts Office of Coastal Zone Management

251 Causeway Street

Suite 800

Boston, Massachusetts 02114-2136

PRSRT STD
US POSTAGE PD
BOSTON, MA
PERMIT # 53295

protecting natural resources while promoting wise coastal development

Coast Lines

2003

Commonwealth of Massachusetts
Mitt Romney, Governor
Kerry Healey, Lieutenant Governor

Executive Office of Environmental Affairs
Ellen Roy Herzfelder, Secretary

Massachusetts Office of Coastal Zone Management
Tom Skinner, Director
251 Causeway Street, Boston, MA 02114
(617) 626-1200

CZM Information Line.....(617) 626-1212
CZM Home Page.....www.mass.gov/czm

CZM Regional Offices

North Shore.....(978) 281-3972
Boston Harbor.....(617) 626-1200
South Shore.....(781) 545-8026
Cape Cod & Islands.....(508) 362-1760
South Coastal.....(508) 946-8990

Editor Anne Donovan
Designer/Assistant Editor Arden Miller
Cover Photo Karen Young
Other Photos unless otherwise noted, NOAA Photo Library

Thanks to the NOAA Photo Library
The National Oceanic and Atmospheric Administration (NOAA) maintains a Web-based library of thousands of photographs and images. This collection, which is easy to search and has a remarkable breadth of materials, is available at **www.photolib.noaa.gov/**

Coastlines is a publication of the Massachusetts Office of Coastal Zone Management (CZM) pursuant to National Oceanic and Atmospheric Administration (NOAA) Award No. NA17OZ2338. This publication is funded (in part) by a grant/cooperative agreement from NOAA. Views expressed herein are those of the author(s) and do not necessarily reflect the views of NOAA or any of its sub-agencies. This information is available in alternate formats upon request.

Printed on Recycled Paper

photo CZM archives

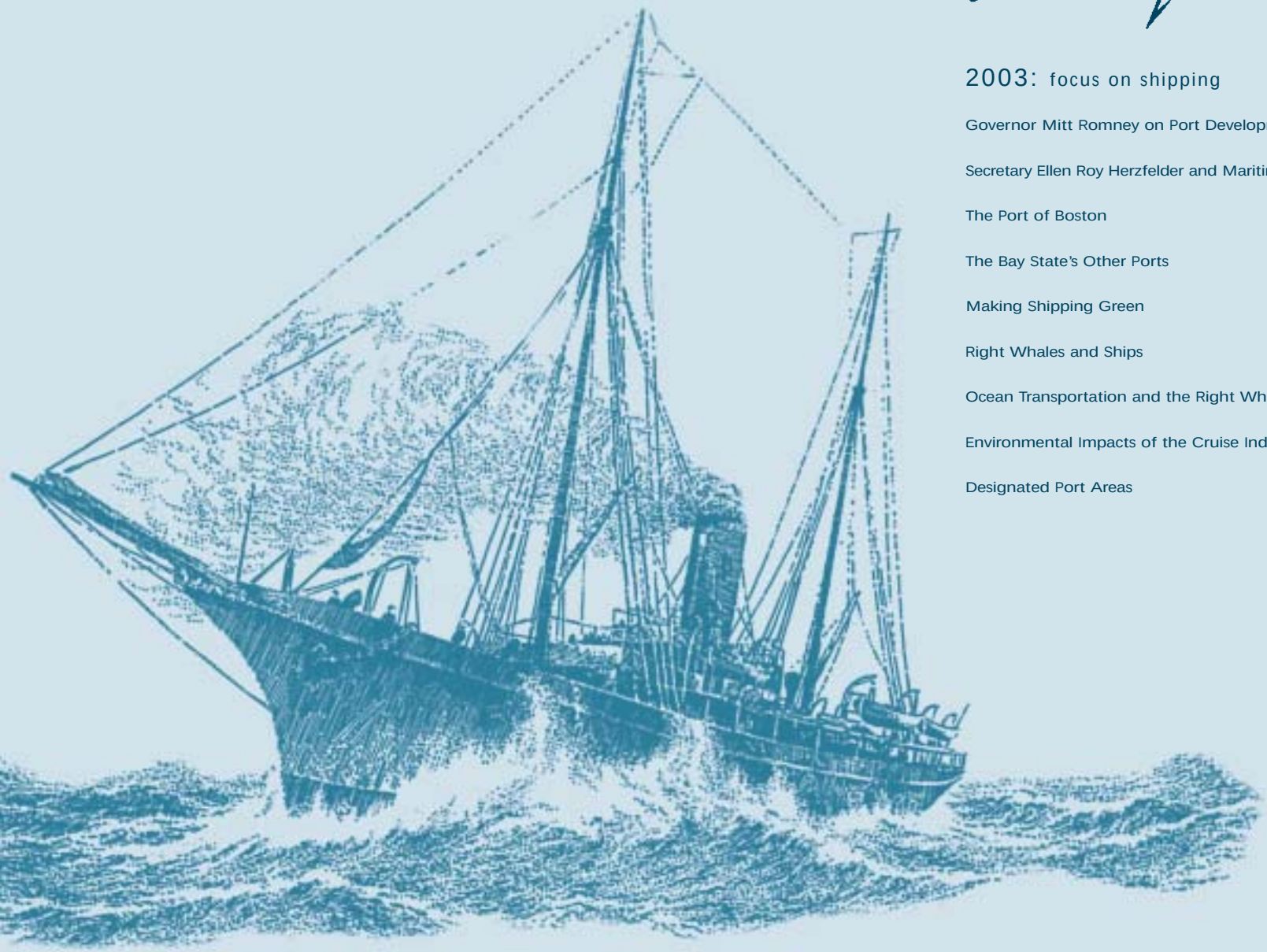
Dear *Coastlines* Reader:

Welcome to the 2003 edition of *Coastlines*, the annual magazine of the Massachusetts Office of Coastal Zone Management (CZM). We appreciate all the feedback we received from readers of the summer 2002 edition and have incorporated many of your suggestions. For monthly news on coastal issues, our electronic newsletter, *CZ-Mail*, has proven very popular. If you are interested in receiving this electronic update, please email czmnews@state.ma.us with your contact information.

For this edition, we have chosen to feature the shipping industry. Long before the Pilgrims landed on Plymouth Rock, shipping has been a cornerstone of the region's culture, economic prosperity, and history. In the past four centuries, shipping has changed dramatically, but it remains a vital part of the Bay State's economy, connecting Massachusetts with markets around the world. Our goal is to support a robust maritime trade industry and healthy, vibrant marine ecosystems. We hope you'll find the array of articles on these topics informative. As always, please feel free to contact us with any comments.

Sincerely,

Tom Skinner
Director
Massachusetts Office of Coastal Zone Management



Coastlines

2003: focus on shipping

Governor Mitt Romney on Port Development page 3

Secretary Ellen Roy Herzfelder and Maritime Industry page 4

The Port of Boston page 6

The Bay State's Other Ports page 12

Making Shipping Green page 17

Right Whales and Ships page 20

Ocean Transportation and the Right Whale page 23

Environmental Impacts of the Cruise Industry page 24

Designated Port Areas page 27

2003: ebb & flow

25 Years of Coastal Zone Management	page 30
Liberty Ships	page 32
The Giant Squid	page 34
CZScience on Stormwater	page 36
Marion: Land of Many Waters	page 40
Coastal Trails on the Web	page 42
Ask Joe Anything	page 43
Ships in a Bottle	page 44

Focus on Port Development

By Governor Mitt Romney

Governor Mitt Romney with Chair of the Seaport Advisory Council, Lieutenant Governor Kerry Healey.

photo courtesy of the Commonwealth of Massachusetts

The ports and harbors of Massachusetts are the original foundation of our wealth and prosperity. While the economy is now far more diverse, the industrial, commercial, and recreational value of our connections to the sea remain fundamentally important to the fortunes of the Commonwealth. Maintaining and improving our maritime facilities to support these uses is good business and good policy.

Investments in maritime industry and infrastructure must be guided by a comprehensive assessment of need, benefit, and cost in the context of long-term municipal and state development goals. Under the Seaport Initiative, the Commonwealth's major port communities have demonstrated their commitment to a port development planning strategy that integrates social, economic, and environmental objectives in formal implementation plans. These Municipal Harbor Plans, developed by the ports in consultation with port professionals; the public; and local and state economic, infrastructure, and environmental staff, establish a management and investment template consistent with statewide policy but specific to the unique circumstances of the individual port.

My administration will work with these port communities to promote maritime trade in Massachusetts in the context of this integrated development approach. To underscore the importance of this partnership, Lieutenant Governor Kerry Healey will serve as my representative and Chair the Seaport Advisory Council, directly assisting in the Council's mission to build port infrastructure, advocate for the maritime community, develop maritime policy for the Commonwealth, and promote the overall economic development of Massachusetts.

New Bedford Harbor: an aerial view of the Commercial Fish Pier. The port of New Bedford/ Fairhaven is home to the largest fishing fleet on the East Coast.

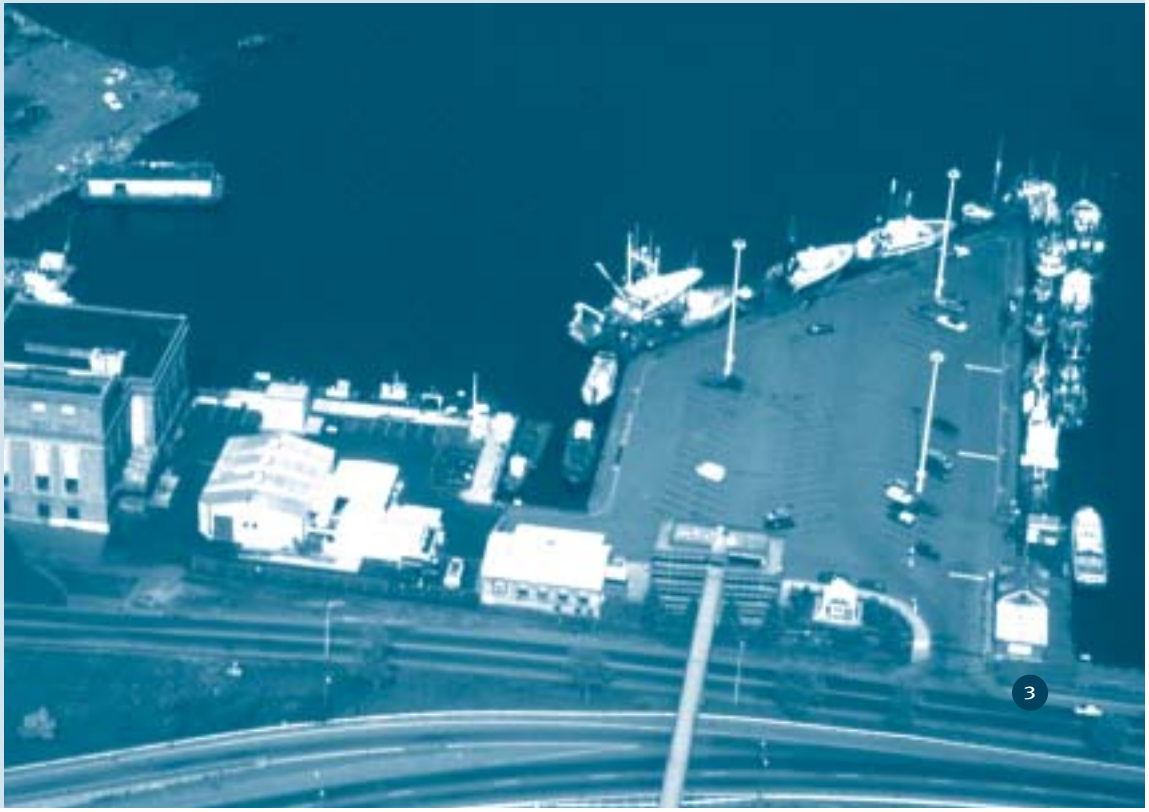


photo by Tom Skinner

Massachusetts' Maritime Tradition and Seafaring Future

By Ellen Roy Herzfelder, Secretary of Environmental Affairs

The Commonwealth of Massachusetts is well known for its coastal natural resources, from expanses of white sandy beaches and rock-bound shores, to picturesque island communities, to quaint harbors and inlets. However, that is only half the story. At the very heart of this state—originating from the earliest of colonial days—is a maritime tradition based on some of the finest natural harbors to be found anywhere. The movement of goods and services through these harbors was the sustenance and strength of a new nation about 226 years ago. Today, maritime commerce remains an integral part of the economic structure of Massachusetts.

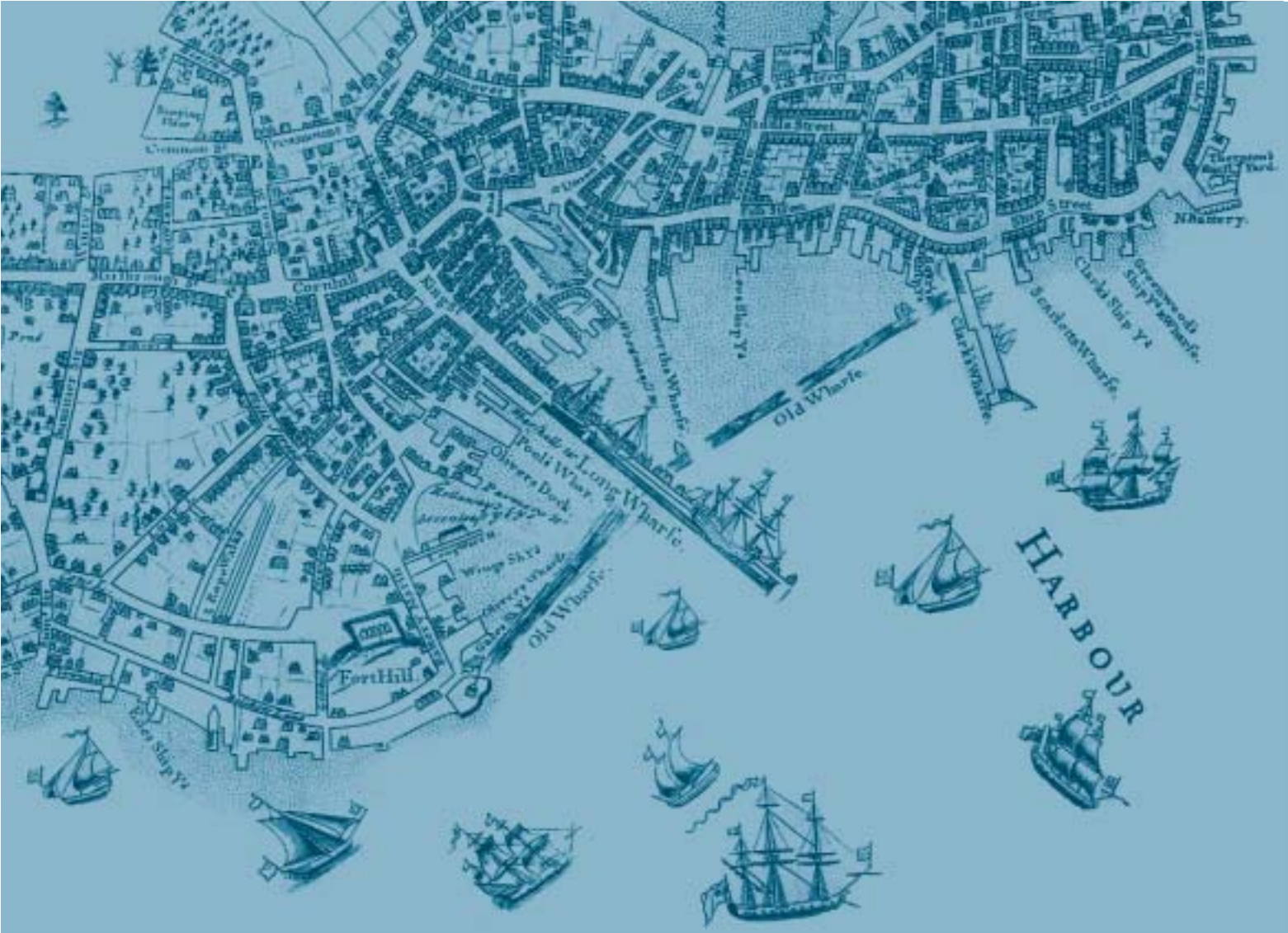
Packing mackerel on the Boston Fish Pier, 1938.

We have seen much change since those early days. Vessels are faster, bigger, deeper, and come and go from every corner of the earth, with cargo movements expected to triple over the next 20 years. The Port of Boston now has direct calls by large container vessels from Europe and the Far East, 14 million tons of bulk cargo enter its waters each year, and last year, 250,000 cruise passengers and over 100,000 automobiles came across its docks. The Port of Boston alone is estimated to have an $8 billion impact on the economy producing more than 9,000 direct jobs.

As a fishing port, New Bedford often exceeds all other U.S. ports in the value of seafood landings (landings that translate into cargo shipped worldwide). Similarly, Gloucester ships packed herring to Europe and the Near East; while lumber, steel, and salt products enter and leave the port of Fall River. The "Port of Massachusetts," the combination of our five largest ports—Fall River, New Bedford, Boston, Salem, and Gloucester—offers the global marketplace unique and special opportunities to engage the economic strengths of the Commonwealth and the region.

To take full advantage of these resources in the expanding global economies of the 21st Century, the Commonwealth will work with the public, federal agencies, representatives of the shipping and fishing industries, and local officials from each of these ports to set the agenda for port planning and development. With Governor Mitt Romney's restructuring of state government, transportation, the environment, and community development are directly coordinated through the Governor's Office, ensuring better delivery of services to our maritime constituents. Coupled with our recently announced Ocean Management Initiative, we are poised to enter a new age of sustainable maritime activity.

For monthly updates on the Ocean Management Initiative, check out CZ-Mail at www.mass.gov/czm/czmail.



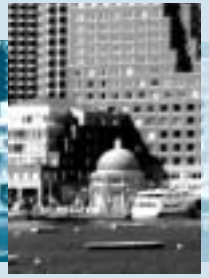
map adapted from *Mapping Boston*; original *The Town of Boston in New England,* John Bonner, 1722

Boston Fish Pier, 1936.

Although shipping has changed dramatically over time, it remains a vital part of the Bay State's economy, connecting Massachusetts with markets around the world.

feature

Shipping in the Bay State



unless otherwise noted, all photos by Jane W. Mead

Through the Eyes of a Mariner: Touring the Port of Boston

By Jane W. Mead, CZM

A tour of Boston Harbor, an estuary sheltered by the arms of Winthrop and Hull, can take many forms. Ferrying around the Boston Harbor Islands, glacial drumlins of such natural and historic interest that they have been named a National Recreation Area, is a wonderful way to enjoy the beauty of the coast. When canoeing through local Areas of Critical Environmental Concern—the Neponset River Estuary, the Back River, and the Weir River—you can see the wildlife that gives statewide significance to these waterways. A stroll along Boston's Harborwalk provides a landside view of historic and cultural features that line the port.

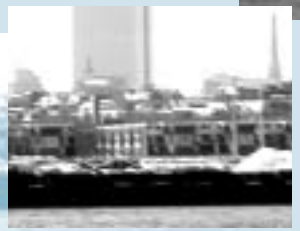
This article gives a different kind of tour, a glimpse into the working waterfront of the Port of Boston, focusing on shipping. In the past year, about $2 billion worth of cargo—loaded on container ships, petroleum tankers, bulk carriers, auto carriers, and cruise ships—traveled in and out of the Port of Boston. The land surrounding the Port supports facilities to process and handle fish and cargos that arrive from or depart to overseas locations. Connecting all is a complex transportation network of boats, trucks, trains, and airplanes riding on water, rail, roads, and air. Though the Port of Boston is somewhat less active than it was in its 19th to mid-20th Century heyday, there is still a lot going on. Working from the south to the north, our waterside tour will point out the places that vessels land and discuss some recent events that affect commercial shipping in and out of the Port.

Quincy-Weymouth

The giant cranes of the old Fore River Shipyard still stand visible throughout the harbor. The cranes mark the Fore River Designated Port Area (DPA), an area maintained under state law for maritime industrial uses. The Fore River DPA is an area of intense activity these days. Though the recent attempt to re-open the shipyard failed, the federal Maritime Administration took bids from companies that proposed retail, residential, and marine industrial uses of the site. The winning bidder, a local car dealer, is working with the City of Quincy to attract a mix of uses to the site.

New England Fertilizer Company receives daily barge-loads of sludge from the Massachusetts Water Resources Authority's (MWRA) Deer Island treatment plant, where the sludge is converted to fertilizer pellets. Both CITGO and Sprague Energy operate tank farms on the Fore River, receiving cargos of oil and gasoline by tanker. Harbor Express provides water-borne commuter transportation to the airport and downtown Boston. The state Highway Department has constructed a temporary bridge over the Fore River and will be replacing the existing antiquated bridge in the coming years.

South Boston and the Inner Harbor



Moving to the northwest, we approach the Port of Boston proper on the recently dredged shipping channels. The U.S. Army Corps of Engineers and the Massachusetts Port Authority (Massport) have accomplished some long-needed channel deepening, bringing the main channel down to a depth of 40 feet below mean low water in the main shipping channel and the Mystic River and 38 feet in the Chelsea Creek (the top of the Ted Williams Tunnel is 40 feet below the surface at low tide, which limits the draft of ships that can go over it to something less than 40 feet). The two agencies are now preparing a feasibility study to dredge the main channels south of the Ted Williams Tunnel to -45 feet to accommodate the deeper draft of modern cargo ships headed to South Boston.

From the water, the Conley Container Terminal appears on the left in South Boston. In the mid-1990s, Massport reconfigured the two main terminals in the Port, consolidating container operations in South Boston and auto imports in Charlestown. At Conley, four cranes move containers on and off of specially designed ships, lowering the metal boxes onto truck chasses for transport out of the city via the Massport Haul Road and the Interstate Highway system.

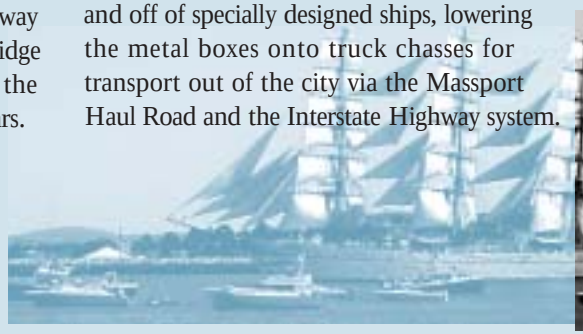


photo by Joseph Staub

Containers that are to be moved by rail must be trucked to the CSX Beacon Yards in Brighton and then transferred to inter-modal railroad cars for shipment.

The past few years have seen international changes in the ways that importers and exporters send and receive containerized cargo, and these changes have affected cargo operations in Boston. A 13-year-old vessel-sharing agreement among SeaLand, Maersk, and P&O Nedlloyd, under which all three companies carried cargo on the same ship once a week to and from Europe, expired in June of 2000, and was not renewed, ending that direct call to the region. Containers from these lines are now delivered from New York and Halifax, Nova Scotia, by feeder barge, an ocean-going barge that delivers containers from a call port to smaller surrounding regional ports. The Mediterranean Shipping Company, which now provides a ship to and from Europe each week, has increased its container volumes, however. A new service from Asia was initiated in January of 2002, linking New England directly with that market. This service—a cooperative effort of four steamship lines (China Ocean Shipping Company [COSCO], K-Line, Yang Ming Line, and Hanjin Shipping)—brings cargo to the United States via the Panama Canal. After calling Boston, the vessel carries export cargo to Europe. A recent addition to the COSCO service is a weekly export ship to Asia.

Goods that arrive in metal boxes include shoes from Italy, wines from France, beer, home goods, granite and marble, toys, foodstuffs, and clothing. Major containerized exports include lumber, paper, hides, medical supplies, and technical equipment.

Several multi-modal freight-forwarding companies are located in the South Boston Marine Industrial Park. These companies receive containers from ships and airport cargos at their facilities, sort their contents, and then re-ship the products to short- and long-haul customers. The opening of the Ted Williams Tunnel has made shipping and receiving to and from the airport and South Boston very convenient and South Boston has rapidly become a good place to locate these businesses.

Black Falcon Pier on the Reserved Channel is the place where the cruise ships dock when they are in Boston. Over the past decade, the cruise industry has become one of the most important segments of the Port economy. In 2002, there were 93 cruises carrying over 200,000 passengers. Trips that begin in Boston may be from one to 10 days or longer and sail to Bermuda, Canada, and Europe. The 24 hours that the ship is in port are frantic with activity as passengers disembark, the ship is cleaned, new stores of food, water, and fuel are loaded, and new passengers are boarded.

Further into the Port is the Fish Pier. Once the home of a large fishing fleet, diminished stock and limits on days at sea have severely reduced the number of commercial fishing boats in Boston, as is the case all over New England. Interestingly though, Boston remains a major fish exporting port. Fish from other parts of the world are flown into Logan Airport and brought to fish plants in South Boston for processing and packaging. The newly transformed fish products are then returned to Logan where they are sent back out around the world. The Boston Lobstermen's Association is still quite active, fishing out of the Cardinal Medeiros dock on the Reserved Channel.

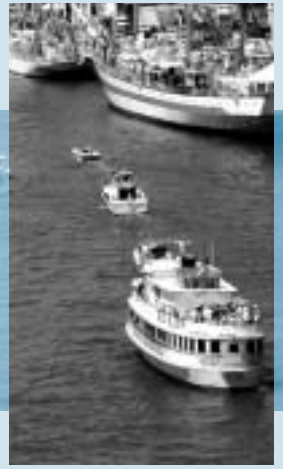


photo by Joseph Staub

Downtown, scores of passenger boats take people on harbor tours, whale watching trips, and longer voyages across Massachusetts Bay to Provincetown. Commuter boats bring in workers from the North and South Shores. Continuing deeper into the harbor, we find the Coast Guard base, providing search and rescue, pollution control, and security for the Captain of the Port of Boston district, which runs from Maine to the Cape Cod Canal.

Mystic River

The intersection of the Inner Harbor, the Mystic River, and Chelsea Creek is called the Confluence. Here, huge Liquid Natural Gas (LNG) tankers headed for the Distrigas Terminal on the Mystic are turned around by tugboats and pulled backward upriver, as they are too big to turn in the river. The natural gas arrives in port as a supercooled liquid. (To keep the gas cold, LNG ships are essentially very large Thermos™ bottles.) To ensure safe passage, a security team accompanies each of the ships. Through these efforts, Distrigas supplies about 15 percent of the natural gas used in the Boston-area market.

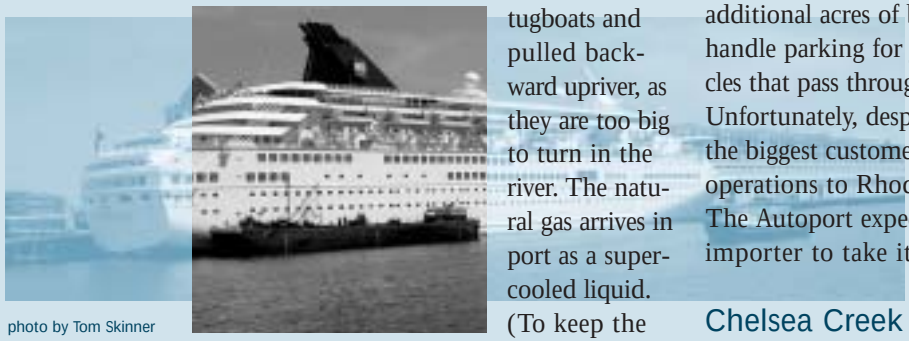
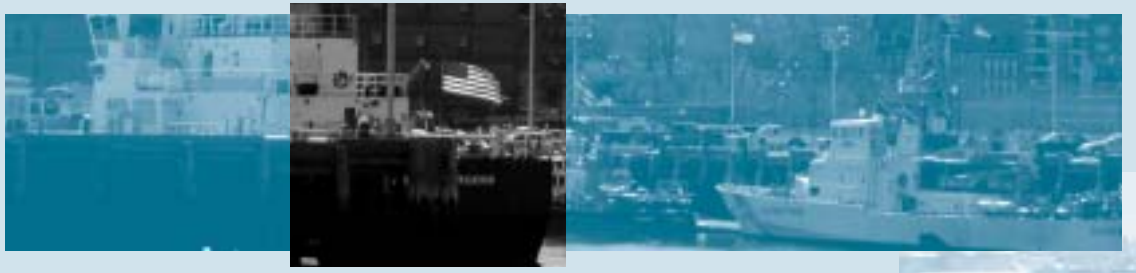


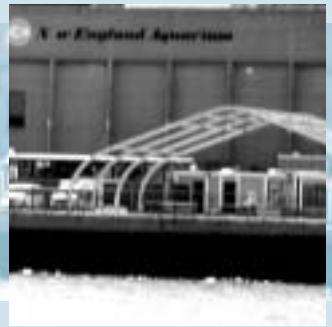
photo by Tom Skinner

The Mystic River and neighboring Chelsea Creek are home to several bulk cargo terminals, where unconfined shipments of gypsum, salt, and cement are off-loaded and scrap metal is on-loaded for export. As car carriers draw relatively little water, once construction of the Ted Williams Tunnel limited future channel depths to -40 feet, Massport moved the entire auto importing business to Moran Terminal in Charlestown when it consolidated container operations in South Boston. One container crane at Moran was removed and the other remains at the edge of the dock, where it is for sale. State-of-the-art auto processing facilities were constructed, and additional acres of backlands were paved to handle parking for just under 100,000 vehicles that pass through the Autoport each year. Unfortunately, despite all of these amenities, the biggest customer, Volkswagen, moved its operations to Rhode Island early in 2003. The Autoport expects to find another auto importer to take its place.

Chelsea Creek

At the mouth of Chelsea Creek, Eastern Minerals receives bulk salt from Chile, Mexico, the Caribbean, Egypt, and Australia. The salt is used by about 200 communities in eastern Massachusetts to melt winter snow and ice from streets and highways. An estimated 70 percent of the petroleum products—including home heating oil, gasoline, and jet fuel—that warm homes and move vehicles in the region are imported through tank farms on Chelsea Creek. Petroleum tankers must pass both the McArdle Bridge in East Boston and the aging and very narrow Chelsea Street Bridge further upstream. The opening through the Chelsea Street Bridge is only 96 feet wide, making for some tricky going for the docking masters on the ocean-going tankers as they thread their way between the fenders. In fact, a special "Chelsea-class" of small tankers remain in service specifically because they fit through the bridge. This bridge is on the list for federal Truman-Hobbs funding for replacement, but construction probably won't start for another few years.





East Boston

Though East Boston was once home to ship-building companies and passenger and cargo wharves, the constrained local roadway system limits large-scale maritime operations. Consequently, the primary remaining maritime businesses are the pilots, the tugboat companies, and other maritime support industries. State pilots meet an incoming ship outside Boston Harbor at the "B" Buoy, about 13 miles offshore, go aboard, and command the ship until the tow boats pick up the ship, usually off of Commonwealth Pier. The docking masters go aboard once the tugboats have come alongside, and command the ship until it gets to the dock where it will discharge or take on cargo.

Future of the Port

Landside access to and from the Port is an on-going challenge. Truck routes follow city streets that were not designed either for 60-foot trailers or for the volume of traffic that they must handle. The problem has been further complicated by the route changes and temporary structures that have attended the construction of the Big Dig and the Ted Williams Tunnel. Construction of both the Big Dig and the Convention Center has interrupted rail service to South Boston, and rail to Moran Terminal in Charlestown has been suspended. Massport has taken several steps to alleviate these problems, including construction of a Haul Road from Northern Avenue out of South Boston to the Interstate system, and, with the Massachusetts Highway Department, construction of the South Boston By-Pass Road, relieving local streets of some truck traffic. Massport has acquired the railbed in Charlestown for another haul road to serve port businesses along the Mystic River.

The cleanup of Boston Harbor, availability of large parcels of land, and the desirability of urban living make residential and commercial development along the waterfront very profitable. Shipping is not, at this point, as profitable, but it is a vital component of the regional economy, generating about 9,000 jobs and an estimated $8 billion in annual economic impact. Maritime industrial uses are now competing with housing and offices for space on the waterfront.

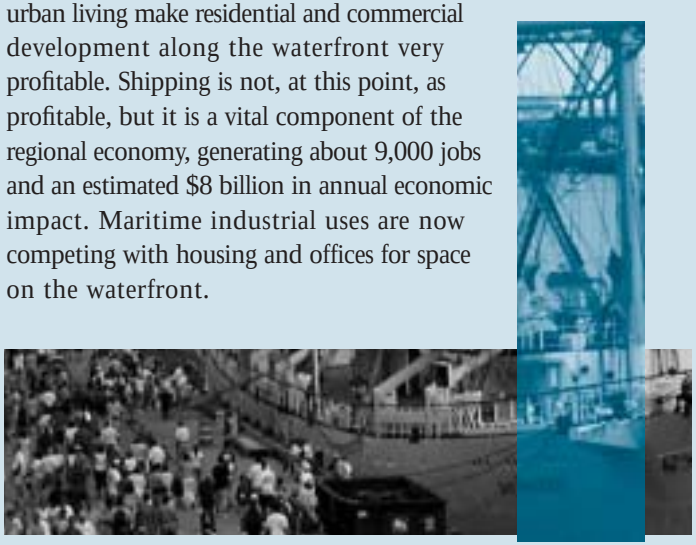
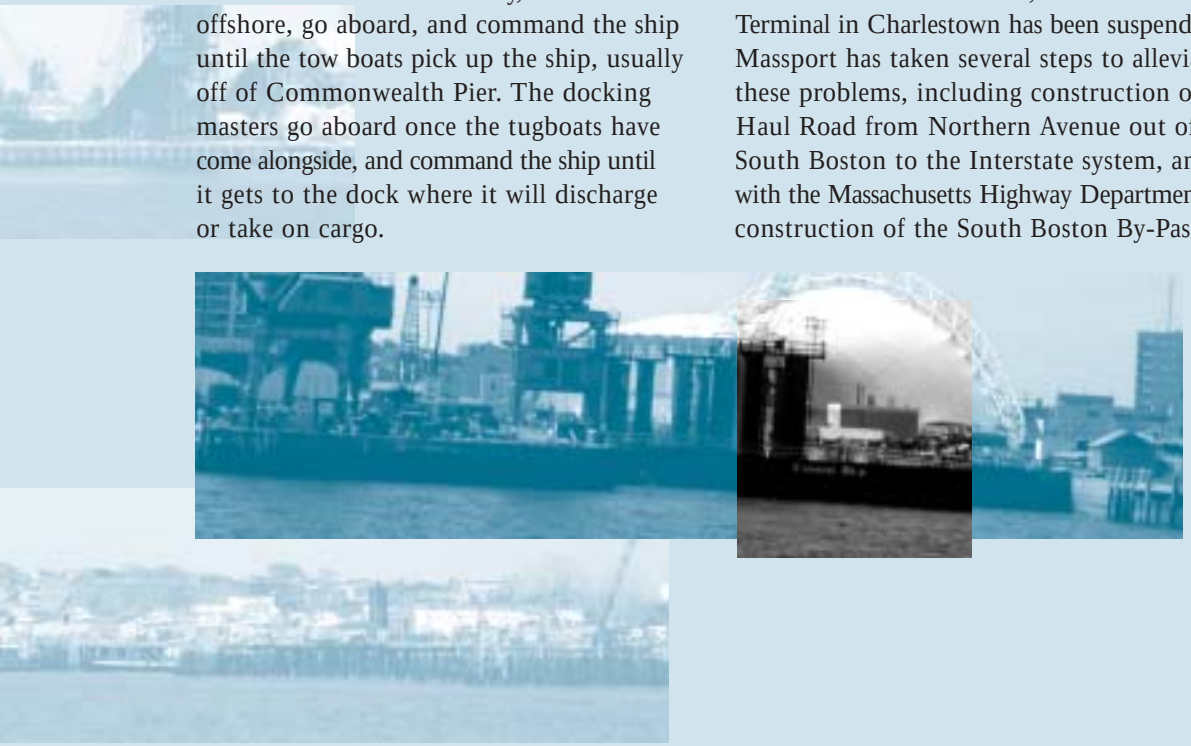
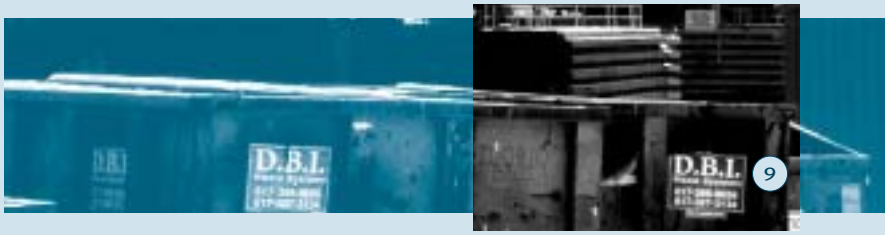
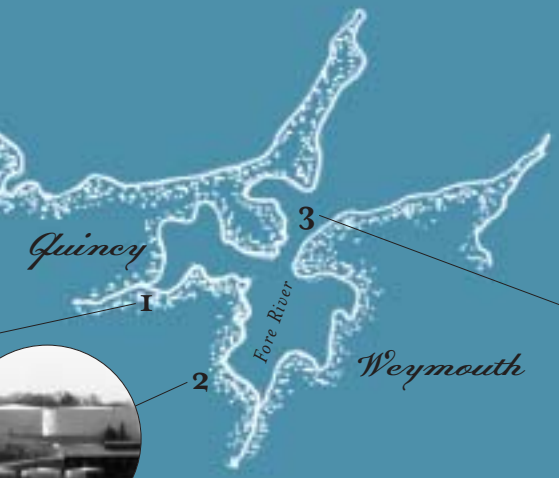


photo by Joseph Staub





Boston & Vicinity



Legend

1. Fore River Shipyard
2. Citgo
3. Rt 3A Bridge
4. Conley Container Terminal
5. Black Falcon Pier
6. Fish Pier
7. Coast Guard Base
8. Distrigas
9. Autoport
10. Eastern Minerals
11. Chelsea Street Bridge
12. Tank Farm Chelsea Creek
13. Boston Pilots
14. Logan Airport

Cartography and photography by Jane W. Mead

Beyond Boston Harbor – The Bay State's "Four Ports"

By Anne Donovan, CZM

Although Boston has been the predominant port in Massachusetts since the early 17th Century, a number of other locations along the Bay State's 1,500-mile coastline have been historically important shipping hubs. Today, four ports beyond Boston continue to play a significant role in the shipping industry, generating more than 10,000 jobs and $2 billion directly to the Commonwealth's economy. These four ports are: Gloucester, Salem, New Bedford/ Fairhaven, and Fall River.

The Fisherman's Memorial commemorates the thousands of Gloucester fishermen who have been lost at sea.

Gloucester

Founded in 1623, Gloucester is the oldest fishing community in the United States. Its protected (and picturesque) harbor and its close proximity to the rich fishing grounds of Georges Bank made it an ideal location to launch a thriving fishing industry. The prosperity of the fishing fleet reached its zenith in the late-1970s and early-1980s, after the United States established the 200-mile fishing limit, preventing foreign fishing competition within that zone. Overfishing led to a dramatic decline in fish caught in the mid-1980s, which turned to a precipitous drop in the early-1990s. The continued struggle of the Georges Bank groundfishery has had a significant impact on the port of Gloucester and its fishermen.

Gloucester is also famous as the birthplace of frozen packaging of fish and other food products. In 1925, Clarence Birdseye invented his frozen packaging process in Gloucester, which grew into a frozen seafood product mecca. Gorton's of Gloucester, a long-established company known for bringing easy-to-prepare fish to American families, fully embraced Birdseye's invention, becoming the famous frozen fish stick and fillet broker that it is today. The omnipresent Gorton's billboard along the Gloucester waterfront—with its larger-than-life raingear-clad fisherman at the helm of a schooner—is a reminder of the continued importance of shipping, fishing, and the frozen fish business in this port city.

Despite the struggles of the fishing industry, Gloucester remains an important Bay State port. Major port industries include commercial fishing, frozen seaport products, and services for small vessel owners. Trade is conducted with Europe, Canada, Asia, and South and Central America, with frozen fish and frozen foods as the primary cargo. Gloucester boasts the largest cold food storage facilities on the East Coast of the United States and the port employs almost 3,000 full-time and 800 part-time employees, and generates $720 million in sales.

Salem

Named for "shalom," the Hebrew word for peace, Salem was established as a farming and fishing community in the 1620s. Although much of its early history is overshadowed by the famous Witch Trials of 1692, Salem has a rich and long-standing maritime tradition as well. Thanks to its success as a major fishing, shipbuilding, and maritime trade center, by 1790 Salem was the sixth largest city in the country and had the highest per capita income. This prosperity was fueled by lucrative trading routes with Asia.

After the War of 1812, the port of Salem suffered as emerging ports elsewhere on the East Coast developed facilities for new, larger ships. While the importance of the port diminished, Salem grew as a manufacturing and retail center, primarily focused on leather goods and shoes. In 1940, Salem's shipping life was revitalized with the New England Power Company's construction of the Salem Power Plant. Historically, to keep this coal- and oil-fired electric generating facility running, more than one million tons of coal and three million barrels of petroleum products have been shipped to Salem each year.

The port of Salem today blends a thriving tourism industry with bulk cargo delivery, primarily for the Salem Power Plant. Along with interstate shipping, South America serves as a major trade route. The port generates a total of $550 million in rents, taxes, and sales. Major tourist attractions include the Peabody Essex Museum, with its worldwide collections underscoring the historical importance of Salem as a major maritime trade center; the Salem Maritime National Historic Site; magnificent 18th Century homes built by wealthy shipping merchants and captains; the 171-foot-long *Friendship*, a scale replica of a 1791 East Indiaman merchant tall ship; Nathaniel Hawthorne's House of Seven Gables; the Salem Willows Amusement Park; and downtown historical museums and cultural events.

New Bedford/Fairhaven

New Bedford's history is strongly linked to shipping, particularly whaling. Immortalized in Herman Melville's *Moby Dick*, which was inspired by a journey Melville took on the *Acushnet* out of New Bedford, the whaling industry put New Bedford on the map as the richest city in the world. In the early and mid-1800s, New Bedford was the world's most successful whaling port, providing huge profits for ship sponsors and earning the city the reputation for unsurpassed riches. New Bedford's whaling merchants were also involved in other maritime enterprises, including shipbuilding and sail making. In fact, shipbuilding was the cornerstone of the port's whaling success, with Joseph Rotch building whaling ships with rendering facilities onboard, allowing the whalers to stay out at sea searching for the next whale, while the one they had just harvested was broken down into oil and other component parts. The city and its harbor are also recognized for their significant role in the Underground Railroad in the mid-1800s.

The discovery of petroleum in 1859 signaled the beginning of the end of the whaling industry, and by the 1920s, seeing the end in sight, the resourceful New Bedford whalermen channeled their profits into offshore fishing vessels. The fishing fleet grew for decades, and through the late-1980s to the present, it has often been ranked near or at the top of U.S. ports for the value of its seafood landings. This success is primarily due to New Bedford being the center of the lucrative sea scallop industry.

Employing 3,700 people and generating $671 million in sales, the port of New Bedford/Fairhaven maintains its status as home to the East Coast's largest fishing fleet and one of the largest seafood processing industries. It also is an important shipping port with major markets including perishable goods (primarily seafood and fresh fruit), vessel service, frozen fish and meat, petroleum products, calcium chloride, lumber, sand, gravel, and salt. This truly global port conducts shipping worldwide. New Bedford/Fairhaven Harbor is part of the New Bedford Free Trade Zone, which provides manufacturing opportunities for duty-free importers and exporters. New Bedford is also a growing

By the early 1800s, whaling had built New Bedford into the richest city in the world.

tourism center, serving as home to the world-class New Bedford Whaling Museum, the New Bedford Whaling National Historical Park, and the County Street historic area with its dozens of mansions built in the golden age of whaling in the early 1800s. Today, one of the Martha's Vineyard Ferries departs from Billy Woods Wharf in New Bedford's outer harbor. New major port and tourism facilities along the waterfront, including an international transportation center, renovations to the state pier, and a world-class Oceanarium, are currently in progress.

Fairhaven is home to Fort Phoenix State Reservation with its remnants of its namesake National Landmark Fort, complete with cannons and views of Buzzards Bay. Fairhaven hosts significant numbers of fishing vessels and one of the larger boat repair industries in the northeast.

Fall River

Despite its location 24 miles up Rhode Island's Narragansett Bay, where the Taunton River meets Mount Hope Bay, the port of Fall River is a thriving shipping location, second only to Boston in cargo volume. Its assets include deep waters and unsurpassed transportation links via rail and road. The port generates more than 3,500 jobs and $709 million in sales. Fall River's trade area includes Europe, the Caribbean, and South America, and its major markets are paper, frozen fish, chemicals, and other break bulk cargoes; vehicle and equipment export; and coal and lignite.

Unlike its sister ports elsewhere in the Commonwealth, Fall River's first major port development project occurred during the Industrial Revolution—a deep-water incubator for the textile industry. Fall River faced economic peril when the textile mills began to move south in the 1930s, but the port rallied, becoming a regional fuel center with a niche trade in bulk cargoes and specialty shipbuilding (located across the river in Somerset). Fall River also developed one of the first tourist-oriented waterfronts in the United States, built around the World War II battleship, the *U.S.S. Massachusetts*.

All of the major ports outside of Boston Harbor have undergone a comprehensive planning process to improve their economic prospects. See *Planning for the Four Ports* on page 15 for more information on development activities for Gloucester, Salem, New Bedford/Fairhaven, and Fall River.

Hail to the four ports and their rich and diverse history! Their individual rise, fall, and now renewed vigor are a testament to the lasting importance of the shipping industry to the Bay State.

Lobster is the most important commercial fishery in the territorial waters of the Commonwealth.

photo by Arden W. Miller

Planning for the Four Ports

By Anne Donovan, CZM

To help coastal communities prepare for the challenges of the 21st Century, the Massachusetts Office of Coastal Zone Management (CZM) works with municipalities to develop and implement harbor plans. Funded under the state's Seaport Bond, extensive harbor planning efforts have been undertaken in the four major ports outside of Boston. The following is an update on port planning progress in these communities.

Gloucester

Gloucester was the first of the four ports to complete its Municipal Harbor Plan, which was approved by the Secretary of Environmental Affairs in July of 1999. The plan provides specific strategies for maintaining the harbor as an active working port, principally dedicated to revitalizing of the fishing industry. The plan also recognizes that the harbor area can accommodate other uses, including visitor-oriented education, recreation, and commerce, and recommends three key actions: 1) upgrading the public infrastructure of the harbor (dredging and navigation, public access, seawalls, wastewater treatment, streets, and parking); 2) strengthening the traditional working port by creating a new, private Gloucester harbor partnership organization that will assist small- to medium-sized businesses on historic finger piers; and 3) capitalizing on the cultural and natural assets of the harbor by developing a maritime museum and attracting private investment to the downtown area. Since plan approval, Gloucester has made tremendous progress with plan implementation, including: successful seawall reconstruction; removal of seven derelict vessels from the harbor; preliminary planning for a Harbor Walk around the inner harbor; rebuilding of St. Peter's Marina, which now provides safe and efficient slips for Gloucester's commercial lobster boats; formation of a Private Gloucester Harbor Partnership Organization; and the completion of a feasibility study for a high-speed passenger and car ferry between Gloucester and Nova Scotia.

Salem

In November of 2000, Salem's Municipal Harbor Plan was officially approved by the state. Salem's plan outlines a comprehensive strategy for protecting and enhancing the economic, environmental, historic, and cultural resources related to Salem Harbor and contains nearly 70 specific recommendations. The most important waterside recommendation is to dredge the harbor to maintain safe navigation. On the landside, a key recommendation is continuous pedestrian access along the edge of Salem Harbor from Winter Island to Palmer Cove, to be known as the "Salem Harbor Walk." Finally, the centerpiece of the plan is a publicly developed, multi-use maritime facility known as New Salem Wharf, which would provide nearly a half-mile of new dockage and associated services for a range of commercial vessel operations, primarily for water-borne passenger transportation. Since plan approval, Salem has been working diligently to implement the plan and has worked with the U.S. Army Corps of Engineers and state agencies to coordinate maintenance dredging of the Federal Channel; planned for construction of a walkway along South River, opening a large waterfront area formerly unavailable to the public (this project is currently being launched with the assistance of CZM and the Department of Environmental Protection); completed the first stage of planning for New Salem Wharf; and initiated the public process for creating a Harbor Overlay District to implement and enforce the Harbor Plan provisions.

New Bedford/Fairhaven

New Bedford Harbor is bounded to the west by New Bedford and the east by Fairhaven. Together, these communities developed the New Bedford/Fairhaven Municipal Harbor Plan, which was approved on September 24, 2002. The plan recognizes the port's status as one of the state's most vibrant Designated Port Areas (DPAs—see page 27) and prioritizes strengthening and supporting the marine industrial activities that are the heart of the port. The plan includes a number of strategies to mobilize investment in the working waterfront, first and foremost focusing on essential transportation infrastructure improvements, specifically dredging, development of a major intermodal transportation center, and the redesign of area highways. In addition, the plan calls for the construction of a ferry terminal, fishing industry pier expansions, and the development of a marine industrial park, among a host of other specific recommendations. To diversify the harbor economy through tourism,

The Port of Salem has a rich and culturally significant maritime tradition.

the plan calls for both waterside and landside infrastructure improvements. In the water, the focus is on expanding recreational boating slips and mooring fields and developing a water taxi service. The ambitious landside strategy includes a network of major open space destinations, anchored by large "island parks" at each end of the harbor. A harbor gateway area is proposed for each community, with extensive streetscape improvements along Main and Middle Streets in Fairhaven and a major Harbor Promenade along the landside edge of the New Bedford fishing piers and the State Pier. New Bedford's proposed Oceanarium is expected to substantially complement these efforts and serve as a cornerstone for future tourism activity in the port. To support tourism and downtown revitalization, a hotel is included in the plan, to be located just outside the DPA. Even though the plan was just recently approved, many plan components were implemented during the planning process. For example, a Quick Start Ferry Terminal has been completed and commenced operation in the summer of 2001 to carry freight to Martha's Vineyard. To support many of these activities, New Bedford completed the first phase of navigational dredging in the summer of 2002. Lastly, to complete the improvements, a major parcel of land within the DPA has been subdivided into an industrial park to be used exclusively for port and marine industrial purposes, especially fish processing.

Fall River

Fall River continues to move ahead with harbor planning and implementation activities. Specifically, design and planning work progresses on a multi-use pier facility to replace the existing building on the State Pier. The plan is to use a two-level strategy for the new building, with the first floor for marine industrial activities and the new second floor for supporting commercial and tourist activities. The western face of the state pier is being rebuilt to be more conducive to the docking of large vessels. The city has begun work on a Harbor Boardwalk extension, which is expected to be completed in October, 2003, and will make the Fall River Boardwalk one of the longest in the state. Fall River has secured close to $1 million for the project thus far and is seeking additional funding through the next Federal Transportation Bond Bill to develop a detailed feasibility study and conception design for rebuilding Route 79 along the waterfront to make it more tourist friendly and to free up several acres of land for commercial development along the waterfront. Environmental assessments have been conducted on the City Pier site, which is targeted for a future hotel and Brownfield cleanup funds are now being pursued. The state has completed a feasibility study on waterfront parking around the State Pier as a first step in looking at parking and port cargo space needs of the area. Future port expansion activities for Fall River include maintenance dredging, accommodation of cruise ships, further developing port operations and industry, industrial waterfront development, and attracting tourism. Tourist sites include Battleship Cove (home to the *U.S.S. Massachusetts*) and the Fall River Heritage State Park with its boardwalk and meadow for picnics and summer concerts.

Together, Fairhaven and New Bedford developed a Municipal Harbor Plan to strengthen and support the marine industrial activities at the heart of the port.

Making Shipping Green

By Anne Donovan, CZM

Shipping provides a host of economic benefits, from providing jobs to connecting the Commonwealth with international trade routes. What are the environmental consequences of reaping these rich economic rewards? How can these environmental impacts be managed and reduced? Through its Green Ports Program, the U.S. Environmental Protection Agency's (EPA) Office of Water is focused on answering these questions and helping U.S. ports combine environmental stewardship with good business. As an important step toward this goal, the EPA funded the *Environmental Management Handbook*, prepared by the American Association of Port Authorities in 1998, to provide practical information for incorporating environmental stewardship into port operation practices. Later, EPA contracted the Urban Harbors Institute at the University of Massachusetts/ Boston to develop a compendium of case studies of innovative and cost-effective strategies used by ports throughout the country to remove, reduce, and/ or remediate environmental impacts of shipping and other port practices. In 2000, the Urban Harbors Institute released *American's Green Ports: Environmental Management and Technology at US Ports*.

This article looks at many of the environmental impacts and solutions discussed in *America's Green Ports*, focusing on the following shipping issues: air quality, dredging, endangered and threatened species, oil pollution, and solid waste.

Air Quality

Shipping vessels, like all hydrocarbon-burning motor vehicles, emit harmful pollutants to the air, such as hydrocarbons, nitrogen oxides, and soot. Other sources of air pollution from the shipping industry include the release of xylene, toluene, and methylene bromide during ship painting and cleaning; benzene, toluene, xylene, and other toxins from fuel vapors; and benzene, toluene, xylene, hexane, and ethyl benzene from loading and unloading marine tank vessels. According to the EPA, impacts of these pollutants may include adverse health effects, such as respiratory and cardiovascular disease, lung damage, learning impairment, and even death; depletion of upper-atmosphere ozone; damage to agricultural resources; and increase in acid rain, endangering forest and plant communities.

America's Green Ports gives an example of how the port of Los Angeles is working to deal with air quality issues. The port retrofitted two tug boats with state-of-the-art equipment to optimize engine efficiency by reducing fuel combustion temperatures, resulting in a 25 percent reduction in air emissions. Cost and performance benefits are also expected, such as longer times between overhauls, reduced maintenance costs, better engine performance, and reduced fuel consumption.

Dredging

To maintain safe navigation depths, many harbor channels must be periodically dredged. This process is greatly complicated by an unwanted legacy of industrialization, i.e. sediment contamination. Sediment contaminants can include heavy metals, polychlorinated biphenyls, polyaromatic hydrocarbons, dioxins, pesticides, oils, greases, and organic matter. If these toxins are released to the water column during dredging, they can pose a significant threat to the ecosystem, particularly through bioaccumulation through the food chain. If they are not properly contained during disposal, these pollutants can have similar effects on the aquatic or terrestrial environment where they are placed. Even uncontaminated dredged materials can have negative environmental impacts when improperly placed in areas where they can smother animals and plants or significantly decrease water quality. The dredging itself can also have significant adverse impacts if scheduled or undertaken improperly.

The Argo Merchant *ran aground in Nantucket Shoals, 29 nautical miles southeast of Nantucket, dumping 7.7 million gallons of fuel into the Atlantic.*

Under current law, all dredging projects must be designed and constructed to protect human and ecological health, and some dredging projects are designed specifically to generate environmental benefits. When Port Canaveral, Florida, was constructed in the 1950s, jetties used to stabilize the entrance channel interrupted the natural flow of sand. This sand blockage caused serious erosion on beaches to the south and made annual

maintenance dredging to keep the channel open a necessity, with the dredged materials deposited at an offshore disposal site. In 1991, the U.S. Fish and Wildlife Service prohibited the continuation of the dredging approach because of potential impacts to endangered sea turtles. The Canaveral Port Authority came up with an alternative plan to remove and reuse beach-compatible sand from the dredged material. The sand is separated and moved to a site a half-mile offshore of the city of Cocoa Beach, where it becomes part of the sand system of the area, renourishing the eroding shore. Monitoring results after the first year indicate that the sand is effectively moving landward, reducing erosion problems and ultimately enhancing nesting habitat for the endangered sea turtles and other animals.

Right here at home, the Boston Harbor Navigation Improvement Project serves as a case study for innovative disposal options for contaminated sediment. After extensive sediment testing and environmental planning, the solution selected for contaminated materials was to dig disposal cells in the bottom of the harbor under the channels being dredged, place the contaminated material in these cells, and then cap them with clean material. Keeping the disposal sites within the dredging footprint eliminated the potentially significant impacts that would have resulted from disturbing another site or transporting this contaminated material, and capping ensured that the material would be removed from the harbor environment.

Endangered and Threatened Species

Animal and plant species that live in ports, as well as the animals that visit, are vulnerable to pollution and noise impacts, as well as ship strikes and encounters with port machinery. An important tool for protecting all species, particularly those that are endangered and threatened, is an inventory of local plants and animals. For those in particular trouble, specific management plans will be required. Here are some examples of how ports are working to “live and let live” with endangered species.

In Port Canaveral, Florida, infrastructure modification and public education have been used to minimize injury to the endangered Florida manatee. Fenders along the channels were modified to give enough room between vessels and walls for manatees to escape without being crushed. Sewer outfalls were covered with grates to prevent the manatees from entering and getting caught in the pipes. Port users were also educated about the presence and movement of manatees in the port, and instructed on the best way to avoid these gentle creatures.

In Massachusetts, the Port of Boston is working to protect the endangered Northern Right Whale, focusing its efforts on educating mariners who pass through whale feeding grounds on the way to and from Boston. Educational tools developed and distributed include a brochure that describes the whales’ behavior and includes photos for identification; a one-page laminated guide to mariner activity around whales; and a 15-minute training video. In addition, the port has set up a sighting network, transferring information about the location of whales from the scientists who collect it to the ships in the area. For more on shipping and right whales in Massachusetts, see pages 20-23.

Oil Pollution

Oil released to marine ecosystems is a major environmental problem associated with the shipping industry. Large spills, which usually occur during transportation accidents like oil tanker groundings, have a catastrophic impact on local plant and animal populations. These incidents are relatively rare, however, and are not the major source of oil in the marine environment. Instead, the cumulative impact of many minor spills is the major culprit, contributing 70 percent of all maritime oil pollution. Although some of this oil is directly released into the water, much is released on land and is transferred to the ocean in stormwater runoff. Small spills from ships occur during fuel loading and off-loading, tank washing, wastewater discharge, bilge water release, and engine maintenance. Oil contains hydrocarbons with BTX compounds (benzene, toluene, and xylene) and toxic metals such as zinc, chromium, copper, and cadmium, which are hazardous to humans and the environment. The impacts include poisoning of marine life, feeding disruption, chronic disease, reproductive problems, and deformities in young. These problems can be exacerbated through bioaccumulation of the toxins through the food chain. In addition, oil pollution degrades coastal habitats, smothering tidal pools and killing marsh grass.

Recycling used oil is an approach some ports are using to help address the oil pollution problem. The Port of Cordova in Alaska collects used oil from harbor users and the surrounding community in convenient dockside oil disposal tanks. A bilge water vacuum pump is also provided for boaters to clean oily bilge water, as well as a facility to collect and treat oily bilge water from larger ships. All the oil collected is tested for contaminants and then transferred to a local utility company, which burns the oil to produce heat. The facility's industrial boiler is certified by EPA for burning both clean and contaminated oil. Public education efforts encourage everyone to participate in this free, cost-effective program.

In the Port of Newport, Oregon, oil filters from commercial and recreational boaters are also recycled. Specially constructed double-walled steel collection tanks are placed in commercial and recreational marinas. An industrial oil filter press crushes the filters and squeezes out the excess oil, which is recycled with the other used oil collected. The filters are also recycled.

Solid Waste

All ships produce solid waste during voyages. Most of this waste can be legally disposed at sea, as long as it is released a specified distance from shore. Plastic, however, must always be properly incinerated or disposed of on land. The amount of solid waste generated is staggering, with cargo ships in the U.S. alone generating more than 111 billion tons of garbage each year. Waste collection and management on shore is not well regulated or consistently managed, and only a minority of vessels actually off-load trash. In addition to legal and illegal ocean dumping, solid waste from shipping enters the environment when cargo is lost at sea, or accidentally released during ship loading and unloading. The impacts of solid waste in the sea include wildlife entanglement and ingestion of materials, particularly plastics; disabling of vessels when debris becomes wrapped around propellers; and aesthetic impacts.

In Oregon, the Port of Newport's Marine Refuse Disposal Project was established as a demonstration project to improve the shoreside management of ship solid waste. Ten refuse facilities were constructed and conveniently placed near boat berths, along with recycling bins for metal, wood, nets, and cardboard. Fishermen, port workers, and managers were also asked to identify solid waste management issues and develop solutions. As a result, a water-level barge was adapted to help fishermen off-load heavy items for disposal and a refuse and recycling area was constructed near the service dock, where a hoist is available for removing heavy materials.

Clearly, many innovative efforts within the shipping industry are working toward making shipping more "green." For a complete PDF copy of *America's Green Ports*, which also covers brownfields, community relations, habitat restoration, and land-based water pollution, go to www.uhi.umb.edu/pdf_files/greenports.pdf. For more on EPA's Green Ports Program, see www.epa.gov/owow/oceans/greenports/ or for the American Association of Port Authorities *Environmental Management Handbook* see www.aapa-ports.org/govrelations/env_mgmt_hb.htm.

Plastics in the ocean are more than a litter problem when seals and other animals become entangled.

Fatal Interaction: Right Whales and Ships

By Joe Pelczarski, CZM

A numbers game... Even though the odds of an individual ship hitting a right whale are miniscule, the sheer number of ships crossing right whale habitat results in a collision every year or two.

With the best available estimates ranging from 300-350 individuals remaining, the Northern Right Whale (*Eubalaena glacialis*) is a critically endangered species. These whales regularly visit Massachusetts waters and the waters of the Great South Channel, Georges Bank, the Gulf of Maine, the Bay of Fundy, and the continental shelf south and east of Nova Scotia. Unfortunately, these feeding pilgrimages can prove deadly when an unlucky whale crosses the path of a large ship. Although the odds of any individual ship hitting a whale are miniscule, the number of ships traversing this area means that typically some ship hits a right whale every year or two.

Right Whales in Peril

In 1935, right whales were first protected by international agreement, which was extended to complete protection by the International Whaling Commission and its implementing convention in 1949. Despite the last 50+ years of protection, the Northern Right Whale population along the east coast of the United States and Canada has shown little recovery. The 1991 Final Recovery Plan and the Draft 2001 Recovery Plan still under review cite ship collisions and entanglements in fishing gear as the most common known cause of anthropogenic (human-caused) mortality for the right whale. Data compiled by the Marine Mammal Commission show there were 52 known right whale deaths between 1970 and 2001—18 of these deaths were due to ship strikes, three were due to entanglements, 16 were considered perinatal (happening around the time of birth of the whale), and 15 were due to unknown causes.

Shipping and Right Whales

Each year, thousands of vessels make thousands of port calls to the United States, carrying many millions of tons of goods worth billions of dollars. The U.S. Army Corps of Engineers publishes shipping statistics in *Waterborne Commerce of the United States* (WCUS). (Statistics for the Atlantic Coast from 1995-2000 are available on the Internet at www.iwr.usace.army.mil /ndc/wcsc.htm.) Hundreds of thousands of vessel trips are made each year along the east coast, with 58,000 to 72,000 trips made in the Gulf of Maine alone. This statistic is important because some female right whales give birth each year in the Florida Gulf during the winter, migrate north to Cape Cod Bay in the spring, and then travel to the upper Bay of Fundy and other areas in the Gulf of Maine and North Atlantic during the summer.

Potential Solutions to Ship Strikes

The National Marine Fisheries Service (NMFS) is charged with protecting the right whale. NMFS has assembled a team of researchers, state and federal agency personnel, and other interested parties, which became known as the Northeast Implementation Team, to help generate proposals to protect the whales. The Team's Ship Strike Committee, with the support and assistance of numerous other agencies and groups, is pursuing solutions to the right whale ship strike problem through education, technology, and ship traffic changes.

Education

Government, researchers, conservation groups, and mariners are working together to inform the shipping community and the public about the ship strike issue through publications, direct information to mariners, and training courses. Important publications include a brochure and laminated placard for mariners with right whale characteristics, migration routes, guidelines on approaching whales, information sources for the most recent sightings, and information about what to do should a collision occur. The National Ocean Service's *U.S. Coast Pilots* now provides information on right whales, where and when they are found, threats posed by ships, and measures to avoid collisions. The National Imagery and Mapping Agency's annual *Notice to Mariners*, published annually by the National Imagery and Mapping Agency, now contains information and precautions on the right whale's habitat in Canadian waters. In addition to publications, information is relayed to ships through a Mandatory Reporting System operated by NMFS, the National Oceanic and Atmospheric Administration, and the U.S. Coast Guard. In critical habitat areas, all commercial ships greater than 300 gross registered tons are required to call into a shore-based station prior to entering the area, prompting a return message with information on the right whale's vulnerability to ship strikes, how collisions can be avoided, and the latest right whale sighting observations. Finally, the Coast Guard's International Safety Management Code now educates mariners on the issues surrounding the protection of endangered marine species. Protected species information is also required in the safety management documents developed by the vessel owners, masters, or shipping company.

Technology

Many vessel operators have indicated that technological solutions could be developed to reduce, if not eliminate, the problem of ships striking right whales. Some technological solutions include starscopes and light gathering technology, active and passive sonar systems, early warning systems, alarms, tagging, satellite imagery, laser infrared detection and ranging, and infrared detection. Although many of these technologies show promise, none are currently economically viable alternatives for consistently alerting mariners to the presence of right whales. Future research and development will be required before a technological solution can be successfully implemented.

Modification of Ship Traffic

This approach aims to keep whales out of harm's way by diverting vessel traffic from areas where right whales are congregating. Because of the great variability in whale behavior, however, additional study and/or continual monitoring are necessary to ensure that traffic changes actually reduce interactions. Numerous specific route changes are under consideration, but only the Bay of Fundy shipping lane north and east has been shifted. The appropriate duration of traffic changes is also under investigation. In some cases, permanent restrictions are under consideration, while other proposals are aimed at seasonal area management (SAM) and dynamic area management (DAM). SAM assumes that right whales will be in a particular area at the same time every year, with speed and/or routing restrictions implemented for that time frame. With DAM, when a group of right whales is found in a particular area, a circle of pre-defined size will be drawn around the animals. Speed and/or routing restrictions will be published and distributed by NMFS and the U.S. Coast Guard and will remain in place for a defined time frame or until the whales disperse, whichever happens first.

Remaining Questions

Currently, all of the options described above on managing ship interactions with marine mammals are before NMFS. The Northeast Implementation Team surveyed its members on the options of speed and traffic changes, and while many members agreed with the logic of the measures, they had questions on the U.S. authority to implement a management action on foreign vessels, enforceability, and the ability to measure an action's success or failure. In addition, economic studies are just being completed that examine the extra costs to vessels by port if speed restrictions are implemented. This type of analysis is a good start but much more is needed to get a valid economic picture of what truly protecting this species will cost. Continuing to work together on solutions that are cost effective, measurable, and effective is the right thing to do for the right whale.

References

Annual Report to Congress 200, Marine Mammal Commission, 4340 East-West Highway, Room 905, Bethesda, Maryland 20814, 31 March 2002.

Silber, Gregory, K. and Clapham, Philip J. *Updated Recovery Plan for the Western North Atlantic Right Whale, Eubalaena glacialis*, Draft, June 2001.

Knowlton, Amy, Kraus, Scott, Meck, Debie, and Mooney-Seus, Marjorie. *Shipping/Right Whale Workshop, New England Aquarium Aquatic Forum Series, Report 97-3*, April 1997.

Waterborne Commerce of the United States, Calendar Year 2000, Part 1, *Waterways and Harbors*, Atlantic Coast, Compiled under supervision of the Institute for Water Resources, U.S. Army Corps of Engineers, Alexandria, VA.

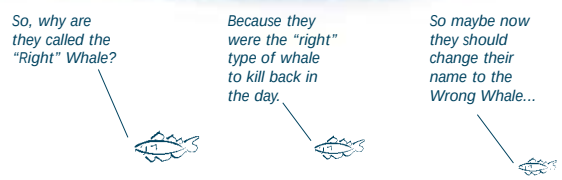
Waterborne Commerce of the United States, Calendar Year 1999, Part 1, *Waterways and Harbors, Atlantic Coast*, Compiled under supervision of the Institute for Water Resources, U.S. Army Corps of Engineers, Alexandria, VA.

Waterborne Commerce of the United States, Calendar Year 1998, Part 1, *Waterways and Harbors, Atlantic Coast*, Compiled under supervision of the Institute for Water Resources, U.S. Army Corps of Engineers, Alexandria, VA.

Waterborne Commerce of the United States, Calendar Year 1997, Part 1, *Waterways and Harbors, Atlantic Coast*, Compiled under supervision of the Institute for Water Resources, U.S. Army Corps of Engineers, Alexandria, VA.

Waterborne Commerce of the United States, Calendar Year 1996, Part 1, *Waterways and Harbors, Atlantic Coast*, Compiled under supervision of the Institute for Water Resources, U.S. Army Corps of Engineers, Alexandria, VA.

Waterborne Commerce of the United States, Calendar Year 1995, Part 1, *Waterways and Harbors, Atlantic Coast*, Compiled under supervision of the Institute for Water Resources, U.S. Army Corps of Engineers, Alexandria, VA.



The Ocean Transportation Industry and the Right Whale

By William C. Eldridge, Vice President, Mediterranean Shipping Co. (Boston) Inc.

Environmentalists, scientists, government regulators, and commercial operators can agree that the problems with protecting the Northern Right Whales are tremendously complex. As my friend Scott Krauss (of the New England Aquarium) said, "There is no silver bullet here." In fact, there is no clear-cut action that will allow us to even begin to solve the Northern Right Whale issue. There is no question of the dedication of the groups of people involved in trying to save the Northern Right Whale; in fact, the efforts of all the different groups, such as the New England Aquarium, National Marine Fisheries Service, U.S. Coast Guard, Center for Coastal Studies, International Fund for Animal Welfare, various port authorities, the fishing industry, and the ocean transportation industry, is inspiring.

Putting the numbers in perspective, what are we really trying to do here? We are trying to reduce roughly two deaths to Northern Right Whales by human hands per year to either one or none. When you consider that there are hundreds of thousands of commercial vessel transits on our coast during the year, and certainly millions if you include fishing vessels and pleasure craft, and add in thousands upon thousands of miles of fishing gear, you can see how we are trying to reduce the odds.

Today, what can we say for a fact will work to prevent possible ship collisions with Northern Right Whales? Educating the mariner is a proven commodity. The increased knowledge in the last five years of mariners sailing on our coast is significant. The word is spread by vessel operators, pilots, shipping lines, the National Marine Fisheries Service, vessel agents, maritime academies, and others, all with enthusiasm and pride. I receive feedback from our vessels' Masters on a regular basis about the whales—they are engaged and serious about the issue, something they would not ever have even thought about five years ago. We in the maritime community should ensure a required curriculum is presented to the International Maritime Organization for any new mariner licenses or the renewal of licenses to make mariners more aware of vessel interactions with all mammals and endangered species—it must begin in the classroom for the next generation of mariners.

Ship routing around known congregations of whales, or areas where whales are known to historically gather, is a solution that should be supported. Ship routing, however, must take into consideration that the vessel cannot be placed into a navigational hazard by re-routing and that the success of any re-routing program would require increased monitoring of the whales and the proper distribution of the whales' locations to the mariner.

There are those who believe rigid speed restrictions are necessary to prevent collisions. Those of us in the maritime community are united in our belief that speed restrictions are not a viable solution. In addition to the legality of speed restrictions under international law and the necessity of vessels to operate at safe speeds predicated on the relevant circumstances and conditions under which each individual vessel operates, there is a large economic impact for delayed vessel calling at ports in New England.

New England is lucky or unlucky depending on your perspective. In New England we get to share in the three largest congregation areas for Northern Right Whales: Cape Cod Bay, the Great South Channel, and the Bay of Fundy. What is also unique to New England is its large tidal range. The tidal range is important because most deep-water vessels are required to dock on high tide and in some cases daylight high tide. The effects of losing even one hour could result in a 12- or 24-hour delay and the costs are significant. The cost of a fully laden Liquid Natural Gas tanker can be in the area of $70,000 per day—so a 12 or 24 hour delay could cost the charterer $35,000-$70,000.

Global containerization is predicated on a fixed, daily schedule. Just-in-time shipping (i.e., the weekly, or sometimes daily deliveries of stock to warehouses) is increasingly becoming the way manufacturers do business. Multimodes of transportation—air, sea, truck, and rail are all competing for cargo; significant delays and added costs can and will divert cargo from one mode of transportation to the other and from one port to another. For all these reasons and more, blanket speed restrictions are not a solution that works for the immediate recovery of the Northern Right Whale.

What can we expect going forward? Absent a technological solution that allows mariners to know where the whales are or a device that warns the whales of a coming vessel, will we ever have consensus? I doubt that we will ever have consensus on speed restrictions, routing, or outright banning of vessels, but I do believe we can all agree that education is a good place to start and more energy/dollars need to be invested in a technological solution.

From the beginning, those of us in the maritime community have been openly involved in this issue. We need to continue to do so and it is imperative that we as the ocean transportation industry—whether it be deep sea vessels, tug & barge units, passenger vessels, or fishing vessels—recognize that reducing the potential of vessels striking Northern Right Whales is essential to the survival of this species. We as an industry must recognize the value these beautiful creatures, as well as all marine animals, provide our fragile ocean systems and as stakeholders we must share these resources responsibly. The work has just begun. The people who work on the water are not ones to quit, the ocean is our home, and I can assure you we will continue to cooperate in saving this great whale.

Cruising Toward a Cleaner Industry

By Shari Currey, CZM

During a single voyage, a modern cruise ship can carry hundreds or even thousands of passengers and crew to exotic coastal locations around the world. All told, the entire global cruise fleet, comprised of over 223 ships, transports an estimated 9.5 million passengers each year. Although cruise lines offer service on every continent, more than half of the global fleet operates in the North American market, with the major U.S. ports of call located in Florida, Alaska, Texas, California, Louisiana, New York, Puerto Rico, and, somewhat surprisingly, Massachusetts.

Here in the Bay State, large cruise ships operate from the Black Falcon Cruise Terminal, located in the heart of Boston's Seaport District. Although the cruise industry in Massachusetts remained rather modest in size through the early 1980s, it has grown rapidly over the past two decades and currently represents the fastest growing segment of Boston's commercial port activity. In 1985, 13 ship calls brought a total of 11,723 visitors to Boston, but since then, Boston has become a premier destination for several major cruise lines that link New England to Canada, Europe, and the Caribbean. It has also become the homeport of Norwegian Majesty, a high-end cruise line that offers weekly service to Bermuda from April through October. Due to the popularity of these cruise lines, Boston received 62 ship calls and 105,000 passengers in 1998, and 118 ship calls and 253,576 passengers in 2001. These numbers will probably continue to rise in the coming years, as the global cruise industry expands its fleet size and increases its overall passenger capacity.

The growth of the cruise industry has had a significant economic impact throughout the United States, including the Commonwealth. According to the International Council of Cruise Lines (ICCL), in 2000, the cruise industry created approximately 170,000 jobs for U.S. citizens and contributed more than $11 billion to the economy by buying goods and services in all 50 states. In Massachusetts, the industry spent over $120 million in 1998 alone, with most revenue benefiting the manufacturing, transportation, communications, and utilities sectors.

However, as the cruise industry has grown, so have concerns surrounding cruise-related marine pollution. According to the Bluewater Network, a national environmental group committed to protecting public waterways, cruise ships produce enormous amounts of hazardous and non-hazardous waste. When improperly disposed of, these substances adversely affect water quality, the marine environment, and public health. Although several federal and state regulations address the disposal of waste produced by vessels such as cruise ships, many obstacles hinder effective enforcement by authorities such as the U.S. Coast Guard and state environmental police.

In a report released by the U.S. General Accounting Office (GAO), cruise ships were linked to 87 cases of illegal discharges in U.S. waters from 1993 to 1998. Many of these cases involved multiple infractions and the overall number of discharges numbered in the hundreds. Although cruise-related cases comprised only a small portion (about four percent) of confirmed illegal dumping in the United States during that six-year period, many of the incidents were highly publicized, particularly those entailing multiple violations, the deliberate bypassing of pollution control devices, and the falsification of records by cruise staff. Most of these cases were handled by the Coast Guard's civil and administrative penalty authorities, but the U.S. Department of Justice prosecuted 10 criminal cases against various cruise ship companies and levied fines ranging from $75,000 to $18 million. In addition to the 87 confirmed cases, 17 cases were referred to other countries for adjudication and an unknown number of incidents went undetected.

In March of 2000, the Bluewater Network responded to the GAO report by petitioning the U.S. Environmental Protection Agency (EPA) to investigate cruise ship pollution and, if necessary, to implement regulatory and policy changes to prevent cruise-related discharges from harming the marine environment. The EPA is currently studying both cruise ship discharges and waste management approaches, and in the meantime, has released a white paper on cruise ship pollution that examines several waste streams including wastewater discharge, solid and hazardous waste disposal, and oily bilge water release. Portions of the white paper are summarized in the *Common Cruise Ship Waste Streams* box on page 26, and the entire report is available online at www.epa.gov/owow/oceans/cruise_ships/assess.html.

Overall, the GAO report concluded that, although the cruise industry has increased its compliance with current environmental legislation, there is a continued need for significant improvement. Specifically, the GAO recommended that the Coast Guard increase its use of aircraft surveillance to monitor cruise ship activity and initiate discussions with the cruise industry, government officials, and environmental groups regarding improved standards for vessel discharge and discharge monitoring. Similarly, the EPA has suggested that federal and state regulations governing cruise ship waste may not be completely comprehensive or adequately enforced. To rectify this, the EPA plans to establish an interagency workgroup with the Coast Guard that will study the volume, characteristics, and environmental impacts of cruise-related waste, scrutinize the effectiveness of existing waste management programs (regulatory and non-regulatory), and explore options for improving overall environmental management within the cruise industry. However, as the Coast Guard takes on added security responsibilities in the wake of September 11, 2001, it remains to be seen whether or not it will be able to increase its role in preventing cruise-related marine pollution.

As a result, state and local governments, industry associations and non-profit groups may have to assume a more prominent role. By issuing more comprehensive regulations, encouraging public-private partnerships, and promoting voluntary compliance programs, these entities could enhance previous and on-going efforts to improve the environmental performance of the cruise industry. Such actions are already taking place in states such as Florida and Alaska, where collaborative efforts between resource management agencies, industry officials, and environmental advocates have resulted in better waste management and disposal practices.

1998 Direct Spending by the Cruise Industry in Massachusetts

Estimates rounded to the nearest $100,000[1]

Transportation, Communications, & Utilities	77,900,000
Total Manufacturing	18,300,000
Nondurable Goods	5,900,000
Durable Goods	12,400,000
Wholesale & Retail Trade	6,800,000
Business Services	16,400,000
Health & Social Services	100,000
Other Services	1,100,000
TOTAL	120,600,000

[1]*Source: ICCL 1999*

photo by Tom Skinner

Alaska has taken steps to control sewage discharge from cruise ships in state waters.

The cruise industry is also directly improving its environmental and waste management practices in many ways. According to the GAO, several cruise lines have implemented comprehensive management plans to clarify environmental policies and enhance waste-handling procedures. They have upgraded waste-treatment equipment, improved employee training and monitoring, and increased both internal and external oversight of their environmental practices and waste management protocols.

Finally, several cruise lines have been certified to be in compliance with the International Safety Management (ISM) Code. The ISM Code was established by the International Maritime Organization (IMO) and sets international standards for vessel-related safety and environmental protection.

Massachusetts is fortunate in that, to date, no cruise-related illegal discharge cases have occurred in its state waters. However, given the increasing popularity and use of Boston as a port of call, the Commonwealth may one day play an important role in ensuring that the growing cruise industry continues to operate in a manner that protects the integrity of New England's coastal waters.

Common Cruise Ship Waste Streams

Wastewater: Wastewater is commonly divided into "black water" (sewage) and "gray water" (shower, sink, and galley water). Sewage discharge contributes to the degradation of the marine environment by introducing excessive nutrients (nitrogen and phosphorus) and disease-causing microorganisms. Moreover, chemicals and deodorizers commonly used in marine sanitation devices (MSDs) often contain chlorine, quaternary ammonia, and formaldehyde, each of which is potentially harmful to marine organisms. Similarly, gray water often contains detergents, cleaners, oil, grease, metals, pesticides, and medical waste that can degrade water quality and harm aquatic life. Although section 312 of the Clean Water Act (CWA) regulates the discharge of wastewater, the Bluewater Network argues that the Coast Guard's methods of inspecting vessels and enforcing regulations are inadequate to ensure CWA compliance.

Solid Waste: Solid waste is comprised of materials such as food waste, plastic, paper, wood, cardboard, cans, and glass. Although these materials are sometimes brought ashore for disposal or recycling, much of it is incinerated on board or dumped overboard, often without proper note in the ship's Garbage Record Book. This is particularly true of plastic, which accounts for most of the solid waste illegally dumped and which adversely affects a variety of marine animals including fish, mammals, turtles, and birds. Despite legislation such as the Marine Protection, Research and Sanctuaries Act (MPRSA) and the Act to Prevent Pollution from Ship (APPS), solid waste disposal by cruise ships remains a serious problem.

Hazardous Waste: Hazardous waste generated aboard cruise ships include an array of chemicals and metals used by onboard dry cleaning facilities, photo processing laboratories, and print shops, as well as paint waste, dirty solvents, and batteries. At this time, little reliable data exist on the quantity of these substances created during any given time. Consequently, it is uncertain what regulations apply to the management and disposal of these substances. The Bluewater Network suggests that the EPA clarify the regulations governing the use and disposal of these substances, both at sea and once offloaded.

Oily Bilge Water: Bilge water often contains a volatile mix of fuel, oil, and wastewater from engines and other machinery found on ships. It may also contain solid wastes such as rags, metal shavings, glass, paint, and cleaning agents. These substances often poison fish and degrade overall water quality. The Oil Pollution Act (OPA) prohibits the discharge of oil and hazardous wastes in quantities that are harmful to U.S. navigable waters or the resources found in the U.S. Exclusive Economic Zone (EEZ). It also requires vessels to record oily discharges in an Oil Record Book. However, since at least one major cruise-related marine pollution case involved routine falsification of this record, the monitoring and enforcement of cruise ship bilge water disposal likely needs improvement.

From the Port Reporter, Vol. 3, February, 1949: *"Skillful cargo handling at the Port of Boston protects the shipper's investment and insures arrival of goods in excellent condition at destination."*

Designated Port Areas: Flexible Protection for a Finite Resource

By Anne Donovan, CZM

When we think of the shrinking availability of finite coastal resources, we usually think about pristine areas like salt marshes and barrier beaches. Images of gritty industrial ports—with diesel exhaust from ships and tugs, heavy equipment unloading cargo, and a din from trucks and rail cars moving about—don't typically jump to mind. But, with the ever-increasing pressure for residential and commercial development along the Commonwealth's coast, working waterfronts are indeed a threatened public resource.

Almost 25 years ago the Massachusetts Office of Coastal Zone Management (CZM) developed a policy to help maintain existing port infrastructure, which was built over the years at great public expense. The policy protects and promotes appropriate marine industrial development in port areas with key industrial attributes, such as deep-water channels, established rail and transportation links, and public utility services conducive to industry. Massachusetts' 11 Designated Port Areas (DPAs) are the cornerstone of this policy. These DPAs provide a home for industries that depend on access to the coast and are located in Gloucester, Salem, Beverly, Lynn, Mystic River, Chelsea Creek, East Boston, South Boston, Weymouth/Fore River, New Bedford-Fairhaven, and Fall River/Mt. Hope Bay.

CZM established the DPA program in 1978 after extensive consultation with municipal planners and leaders of the marine business community. The following year, the Department of Environmental Protection (DEP) incorporated the program into its Waterways regulations, adopting rules that prevent development in DPAs that has the effect of excluding water-dependent industries. The types of development that conflict with maritime industrial use include condominiums and other residential development, hotels, and recreational boating facilities. This approach is critical—once space for water-dependent industry is lost to other development, it is virtually irretrievable. Creating new infrastructure in other areas requires dredging deep channels, altering natural shorelines with extensive fill and structures, and connecting into existing transportation and utility networks. Such measures are prohibitively costly in both monetary and environmental terms.

For Massachusetts to take maximum advantage of future economic opportunities in the marine industrial sector, therefore, what remains of the industrialized coast must be preserved, while new maritime industry is promoted. DPAs are a flexible and effective tool for accomplishing these goals. DPAs are not treated as pure land banks where space not being used for water-dependent industry is off limits to other productive enterprises. Instead, the regulations simply prevent DPA parcels from being used in ways that will diminish the capacity of the DPA to support maritime development in the long run. The result can be a mix of maritime industry with general commercial and industrial activities, as well as safe and interesting public accessways interspersed along the industrial waterfront. Thoughtful and flexible DPA planning is the key to ensuring maximum benefits, where current economic development and public use does not preclude future maritime opportunities.

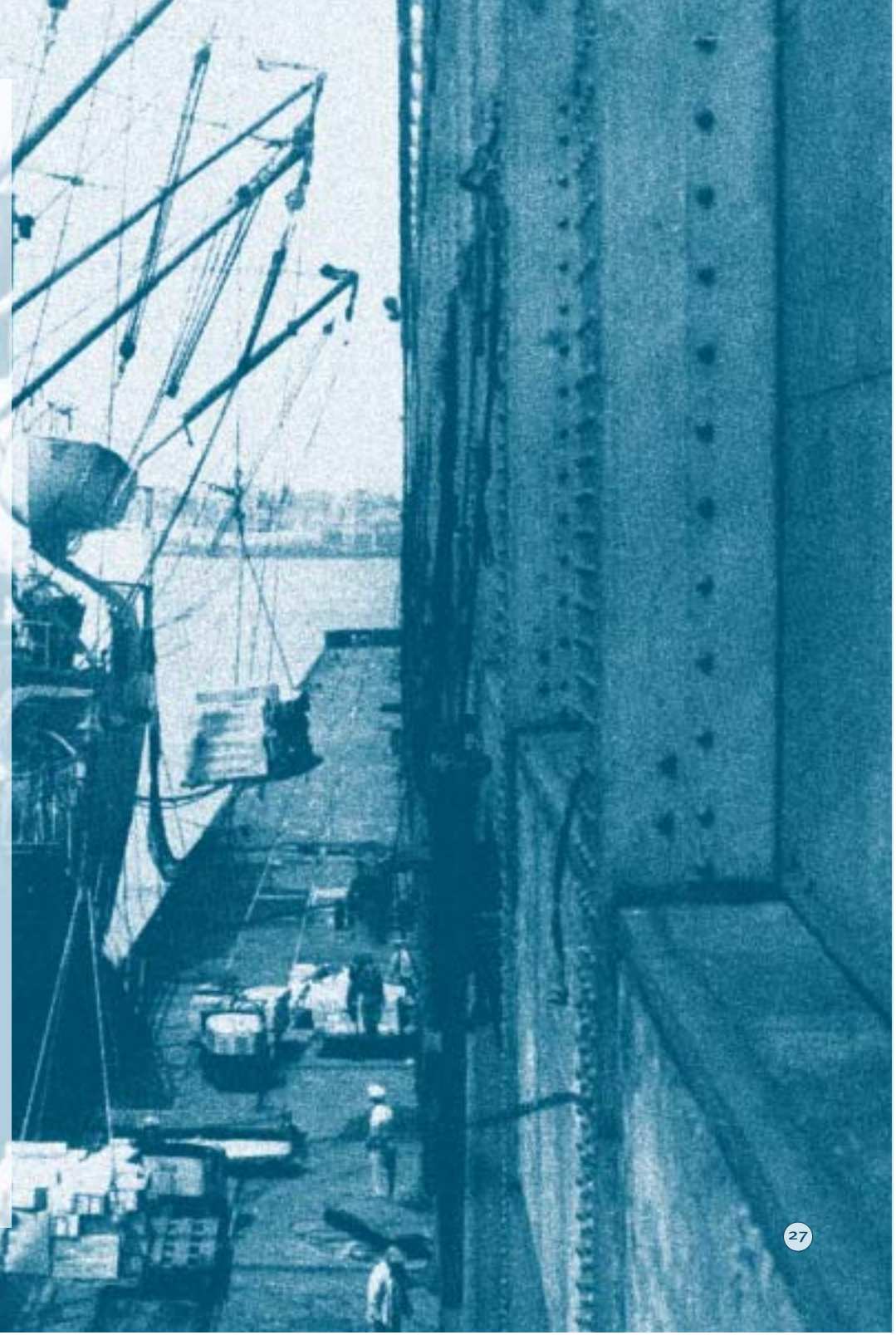
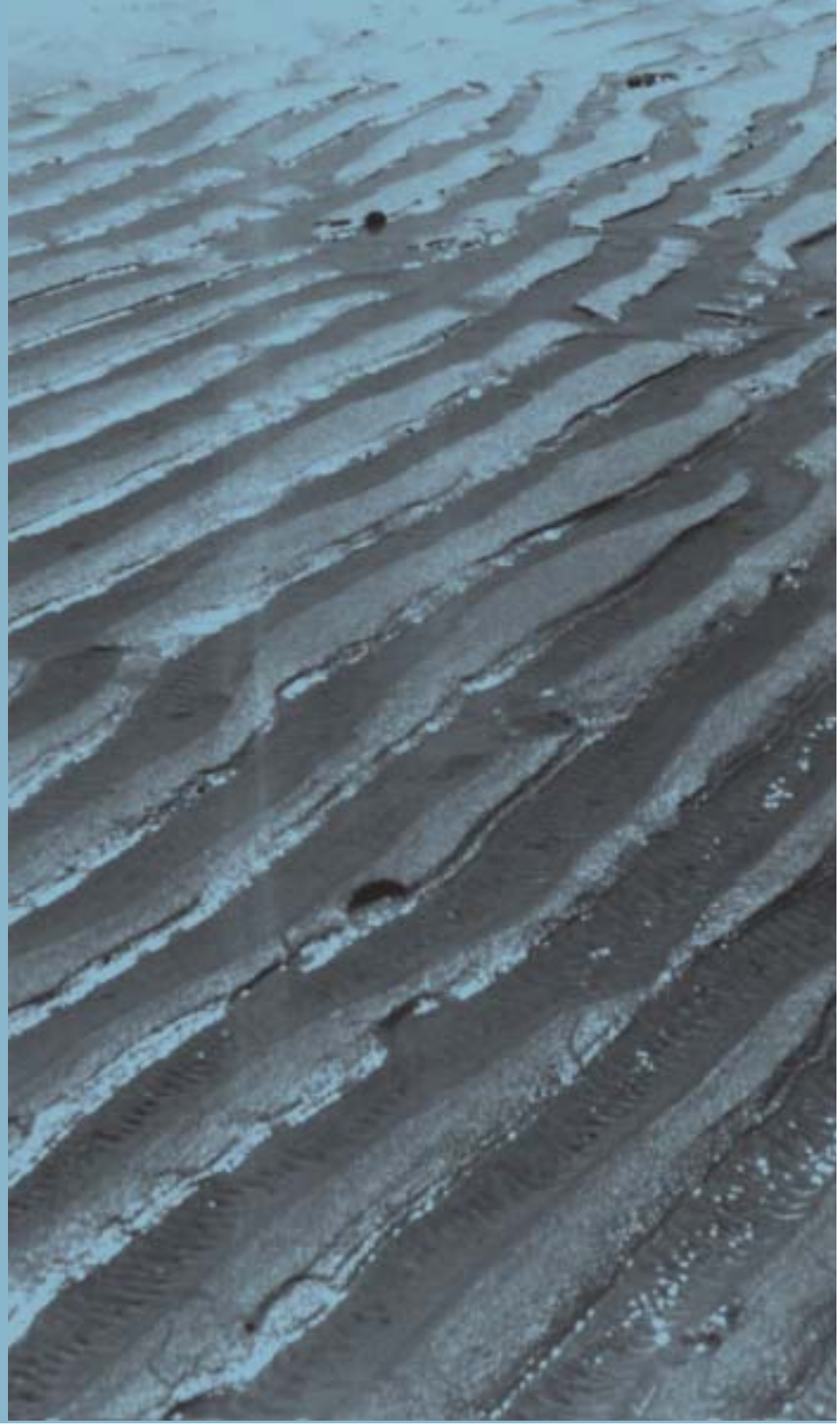


photo courtesy of the Commonwealth of Massachusetts

Focus on Marion 40

Coastal Trails on the Web 42

25 Years of CZM 30



ebb & flow

events and issues around the coast

36 CZScience

43 Ask Joe

25 Years of Coastal Zone Management in Massachusetts: some highlights...

1978

Massachusetts becomes the first state on the eastern seaboard to receive federal approval for its coastal zone management plan.

Coastal Zone Management (CZM) begins the Community Assistance Grant programs, which will ultimately award more than $1 million for port and harbor development and waterfront renewal plans.

CZM organizes 15 local disaster assistance centers to help those affected by the Blizzard of '78.

1980

The Oil Spill Contingency Planning Program is inaugurated and administered by CZM, providing funds for trainings and containment equipment.

To commemorate the Year of the Coast, CZM serves as the statewide clearinghouse for all activities related to public access along the Massachusetts shoreline.

1982

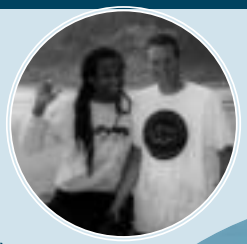
COASTWEEKS, a three-week celebration in every coastal state, is created as a follow up to the Year of the Coast and is modeled after a Wellfleet project.

A status report on polychlorinated biphenyl (PCB) pollution in the New Bedford area is released by CZM, leading to the designation of the Acushnet River estuary as a federal Superfund site, ensuring that the PCB contamination gets cleaned up.

1983

The Legislature formally designates CZM as the lead coastal issues agency within the Executive Office of Environmental Affairs (EOEA).

Chapter 91 of Massachusetts General Laws is amended to increase the protection of public rights in tidelands, both flowed and filled.



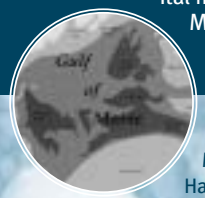
The Coastal Facilities Improvement Program (CFIP) is created. Administered by CZM, the program allocates $18 million in state bond funds to communities for construction, repair, and maintenance of coastal facilities.

1984

Massachusetts wins a lawsuit to halt oil and gas lease sales on Georges Bank.

1989

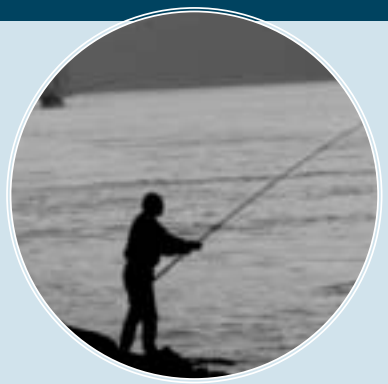
CZM completes the first historical shoreline change digital mapping project for Massachusetts' coastline covering the years 1850-1978.



The Governors of Massachusetts, New Hampshire, and Maine sign an agreement with the Premiers of New Brunswick and Nova Scotia pledging to protect the environmental integrity of the Gulf of Maine. The Gulf of Maine Council is established to execute this agreement.

1990

The CZM-administered Massachusetts Bays Program becomes the second National Estuary Program in Massachusetts.



1992

EOEA and the U.S. Environmental Protection Agency designate the coastal waters of Wareham as the first No Discharge Area (NDA) in the state.

The Stellwagen Bank area off Massachusetts is designated a national marine sanctuary because of its remarkable biological, geological, oceanographic, and cultural attributes.

1995

CZM produces the *Aquaculture Strategic Plan*, a five-year action plan to encourage growth of the aquaculture industry in Massachusetts.

CZM produces *The Massachusetts Coast Guide: Access to Public Open Spaces Along the Shoreline*, a guide with details on nearly 400 public coastal access sites.

1997

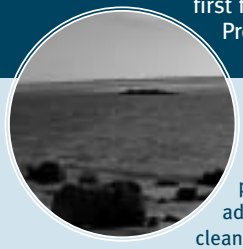
CZM receives federal approval of its Coastal Nonpoint Pollution Control Plan.

CZM deploys a state-of-the-art monitoring buoy in Mount Hope Bay to continuously monitor dissolved oxygen levels.

photos from a variety of sources, including: CZM Archives, Massachusetts Bays Program, NOAA, Arden Miller, & Tom Skinner

1985

The Buzzards Bay Project (administered by CZM) is established as one of the first four National Estuary Programs in the country.



Legislation creating the Massachusetts Water Resources Authority is passed to specifically address the Boston Harbor cleanup project.

1986

CZM collaborates with the National Park Service and the Massachusetts Historical Commission to preserve three historic lighthouses on Cape Cod.

CZM establishes a harbor planning program to coordinate technical and financial assistance to coastal communities for harbor planning.

1987

CZM organizes the first COASTSWEEP cleanup; 391 people from 25 communities participate.

1988

CZM plays a leading role in getting Waquoit Bay designated as the 17th National Estuarine Research Reserve in the country.

1999

Gloucester is the first of the "Four Ports" to complete a Municipal Harbor Plan to revitalize its waterfront.

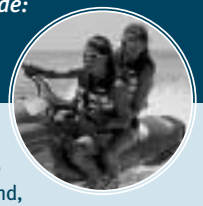
2001

CZM provides funds to support coastal land acquisition projects in Kingston, Dartmouth, and Rowley.

CZM kicks off the Clean Marine Initiative to provide: cleaner marine engines to municipalities, bilge socks to boat owners, technical assistance to marinas, and pumpout information to the public.

2002

CZM produces *Personal Watercraft (PWC) Management Guide: A Comprehensive Reference Handbook.*



CZM updates shoreline change maps to include 1994 data and, along with MassGIS, produces an interactive web site, making all 76 maps easily accessible to coastal property owners.

CZM leads the effort to complete the *Massachusetts Aquatic Invasive Species Management Plan*, developing monitoring and prevention strategies as well as educational efforts.

2003

CZM partners with the Waqoit Bay National Research Reserve and Woods Hole Sea Grant to launch the first NOAA-approved Coastal Training Program in the nation.

In Pursuit of Life and Liberty Ships

By Dave Trubey, BUAR

Despite being branded by Franklin D. Roosevelt with the less than flattering nickname of "the ugly ducklings," perhaps no other vessels revolutionized American shipbuilding as did the Liberty Ships of WWII.

In the early years of war, Great Britain relied heavily on allied shipping to supplement its dwindling supplies of food and raw materials. The fall of France in 1940 brought this situation to a crisis point with the German navy launching highly destructive U-boat strikes from ports all along the 2,500-mile French coast. In an attempt to counter this deadly threat, Great Britain turned to the United States to provide 60 new cargo vessels based on a simple British design. The 60 vessels were quickly followed by the implementation of an emergency building program in the U.S., which by 1942, called for 1,600 ships.

Under the direction of Henry Kaiser and the auspices of the Maritime Commission, the principles of mass production were, for the first time, incorporated into the shipbuilding trade on such a large and successful scale. Whereas traditional shipbuilding was from the keel up with the vessel being completely constructed on the ways, Kaiser's plan was based on modular hull construction and included the production of more than 30,000 components per ship in thousands of factories across the country. In shipyards on both coasts, entire bulkheads were pre-assembled in different areas of the yards from which they were moved in assembly-line fashion and attached to bow and stern sections. In another break from traditional construction techniques, the welding of hull plates replaced the labor-intensive practice of riveting, resulting in a much smoother hull with less friction through the water. The successful application of mass production to the Liberty Ship building program meant that more ships could be constructed in a smaller amount of space and with unprecedented speed.

By the fall of 1942, the production rate of the Liberty Ships had far exceeded the expectations of the Maritime Commission with an average construction period of 70 days. In September, Henry Kaiser's Portland, Oregon yard set a record by completing the *Joseph N. Teal* in a mere 10 days. By the end of the war,15 shipyards had produced 2,710 Liberty Ships. Combined with the construction of other freighters and auxiliary naval craft, this massive undertaking resulted in an increase in U.S. shipbuilding for the years 1941 to 1945 of nearly 1,200 percent and an increase in the industry's workforce of nearly 1,400,000 workers.

The standard Liberty Ship, categorized by the Maritime Commission as an EC2 ("Emergency Cargo") vessel measured between 400 and 450 feet in length, nearly 60 feet in breadth, drew close to 40 feet of water and typically had five holds for dry cargo. Due to a shortage of diesel engines and turbines—the U.S. production of which was designated for its own naval vessels—the Liberty Ships were commonly powered by coal fired triple-expansion reciprocating steam engines, which produced a maximum speed of approximately 11 knots.

Service on a Liberty Ship was considered a dangerous task to say the least. While the assembly process was speedy, Liberty Ships, especially when fully laden with cargo, were slow in the water, making them easy prey for German U-boats. Although intended to traverse the seas in convoy and with a naval escort, this was not always possible, particularly as the war progressed and naval resources were spread thin. The combined lack of speed and escorts, in addition to some early structural problems, earned these vessels the dubious nickname of "Kaiser's Coffins" as many merchant mariners were lost at sea. The threat of enemy attack was somewhat alleviated, when in 1942, the Navy began outfitting merchant vessels with weapons and armed guards.

First known photograph of the James Longstreet *taken at Southampton, England in 1943.*

photos courtesy of Noel W. Beyle

James Longstreet *site as it appeared in the early 1990s.*

Despite reaping the praise of both President Eisenhower and General Douglas McArthur following the war, many consider the men that served aboard these important vessels the forgotten sailors of WWII, as those who returned home were denied benefits for injuries and often overlooked in victory celebrations. In recent years, maritime and naval historians have begun to shed light on the significant contribution of the Liberty Ships and their builders and sailors. Their contribution to the war effort was tremendous—they were responsible for carrying 2/3 of all cargo leaving U.S. ports in support of the Allies overseas. This achievement is matched by their contribution to the advancement of shipbuilding technology. Today, only two unaltered Liberty Ships remain afloat; the San Francisco-based *Jeremiah O'Brien* and the *John W. Brown* of Baltimore.

James E. Longstreet: History

The coast of Eastham, Massachusetts is home to the remains of one Liberty Ship, the *James E. Longstreet*, which until recently was a visible fixture on the horizon for many residents of Cape Cod.

The *James E. Longstreet* was constructed in 1942 by the Todd Houston Shipbuilding Corporation of Irish Bend, Houston, Texas, for a cost of approximately $1,833,400. As a standard Liberty Ship, it measured close to 417 feet in length, 57 feet in breadth, and drew nearly 37 feet of water. The vessel was named for Major General James Longstreet, a hero of the Confederate Army and one of General Robert E. Lee's top officers during the Civil War.

Although by measurement and design the *James E. Longstreet* was a typical liberty ship, its career was far from ordinary, seemingly marred by mishaps right from the start. While awaiting a pilot to take the vessel into New York Harbor following its arrival from Southampton, England, the *Longstreet* was caught in a violent gale that continued for more than 24 hours. Together with two other vessels, the *Exilona* and the *Fort Douglas*, the *Longstreet* was driven ashore at Sandy Hook, New Jersey, on October 26, 1943. Given the order to abandon ship, the freighter's crew of about 70 was removed by the Coast Guard.

Although the rescue was conducted more for the benefit of observing reporters—most of the crew was capable of wading safely to shore—the *Longstreet* nevertheless sustained damage when its hull split near the number three hold. Temporarily repaired on site, it was re-floated on November 25, 1943, after a channel was dredged from behind. From there, the scarred vessel was towed to New York Harbor.

Declared a total loss, the *James E. Longstreet* was ready for the scrap yard when the U.S. Navy requested it for use as a target ship for secret experiments involving early air-to-surface guided missile systems. Stripped of its equipment and painted chrome yellow, the *Longstreet* was delivered to the Navy in June of 1944.

Following repairs of missile damage sustained over the summer months, the Longstreet was under tow back to the target area when it broke loose and grounded for a second time, near the Ambrose Channel, not far from New York. Once again, the vessel was re-floated, repaired, and towed to the target area where it was moored until a severe winter storm parted its mooring cable allowing it to drift some 80 miles out to sea. Recovered 10 days later, the *Longstreet* was finally towed to the waters off Eastham, Massachusetts where it was sunk in approximately 20 feet of water to serve as a target for new air-to-surface guided missile experiments involving a heat-seeking system known as the Dove. By the middle of 1946, the service of the *Longstreet* was no longer required for the Dove program and the vessel was used periodically by the Navy and Air Force for live ammunition target practice until 1971.

Side scan sonar record of James Longstreet site as it appeared in September of 2003.

Today, the Liberty Ship *James E. Longstreet* remains approximately three and a half miles off Eastham, Massachusetts in 20 to 25 feet of water with only a small portion of its structure above the surface. Full of holes and nearly cut in two, the large hulk is a favorite diving and fishing spot as the area is home to numerous flounder, tautog, fluke, and lobsters.

sonar image courtesy of American Underwater Search and Survey

A Great Monster of the Deep in Massachusetts

By Anne Donovan, CZM

Black eyes the size of a dinner plate search through the gloom 2,000 feet below. Eight 10-foot-long arms, covered with two rows of toothed suckers, gently sway. Two immense feeding tentacles, 35-feet long, perch, ready to strike. The huge, sharp, parrot-like beak remains slightly ajar in anticipation of a meal. Reaching a conservative estimate of 60 feet in length and weighing nearly a ton, this creature is truly a monster of the deep. The world's largest invertebrate—*Architeuthis dux*—the giant squid. Despite extensive undertakings, it has never been seen alive in its natural deep-water environment, but we know it's out there. One even visited our very shores, washing up on Plum Island in 1980.

Only the third giant squid ever found in U.S. waters, what remains of this nine-foot, 440-pound specimen has a place of honor in the Smithsonian Institution National Museum of Natural History in Washington, DC. Even pickled in a glass tank that looks more like a tomb, this visitor from the deep gives an impressive glimpse into what's down there, currently beyond the reach of science and almost beyond imagination. When alive, this young female probably reached 20-feet in length, only a third of its potential size. With her complex brain and huge eyes, she sought out her prey, mainly fish and other squid, likely living out her life at a depth of 660 to 2,300 feet before some unknown event took her life and brought her to shore.

The giant squid is the stuff of legends. A prey item of the sperm whale, these monster invertebrates are known to put up a fight with these massive predators. In 1965, the crew of a Soviet whaler claimed to have witnessed a 40-ton sperm whale embattled with a giant squid. Although the squid didn't exactly win, neither did the whale. The whale was found floating, dead and strangled, the tentacles of the giant squid still wrapped around its body. The head of the squid was found in the whale's stomach.

Even more bizarre is the alleged encounter of a giant squid with the

Unlike its little cousin pictured here, the giant squid has never been photographed alive.

What becomes a legend? Stamps from around the world commemorate the giant squid.

Brunswick, a 15,000-ton auxiliary tanker owned by the Royal Norwegian Navy. In the 1930s, a giant squid is said to have attacked the vessel at least three times. Perhaps mistaking the vessel for its arch enemy, the sperm whale, the deliberate squid pulled alongside the ship, kept pace with its movement, and then suddenly wrapped its tentacles around the hull. The squid didn't win this battle either. Unable to get a good grip, it ultimately slid off into the ships propellers.

Reality or really big fish stories? Although the most prominent giant squid scientists consider such tales more fancy than fact, two things are known with scientific certainty. The beaks of giant squid are frequently found in the stomachs of sperm whales, proving that these giant predators dine on this giant prey. Sperm whales have also been found with 2-inch tentacle scars on their skin, demonstrating beyond a shadow of a doubt that giant squid can and will put up a fight.

Overall, not much is known about these clearly amazing sea creatures. Because of the specimens found in fishermen's nets and washed up on shore, scientists are certain that giant squid live in all oceans of the world. The actual depth they live at, how they feed and reproduce, and even how old they get is still a mystery, however. But the search continues . . .

For more on the giant squid, check out these Web sites:

- http://seawifs.gsfc.nasa.gov/OCEAN_PLANET/HTML/squid_opening.html
- http://partners.si.edu/squid/

Giant squid suckers are approximately 2 inches across.

CZScience: Evaluating the Connection—Stormwater Runoff, Impervious Surfaces, and Pollution

By Christian Krahforst, CZM

On June 6 and 7, 2002, approximately 2.25 inches of rain fell in the Boston area, much more water than is typically observed during an "average" rainfall in this region of Massachusetts. Most rain events, as observed from 10 years of data collected at Logan Airport, deliver just less than 0.25 inches and typically last for about 6 hours. Over these two days in June, approximately 11.5 billion gallons of water were delivered to the watershed of metropolitan Boston—enough to supply the 1.1 million people living there with household water for approximately 150 days. (In North America, the average person uses about 60-80 gallons of water each day.) However, this stormwater was not captured for our daily use. Where did all this water go and what was its legacy? To better understand the fate and impact of this rainwater, let's start with the concepts of watersheds and the hydrologic cycle.

What Is a Watershed?

Watersheds are defined as geographic areas of land in which all surface and ground water flows downhill to a common point, such as a river, stream, pond, lake, wetland, or estuary. Topography, soil and bedrock geology, and land use (e.g., forested, residential, wetlands, commercial) are important characteristics that affect stormwater drainage within a watershed. For more on watersheds, see www.state.ma.us/envir/mwi/watersheds.htm.

What Is the Hydrologic Cycle?

The hydrologic cycle describes the movement of water (all three forms: solid, liquid, and vapor) through the environment. Generally, this movement is the result of precipitation, runoff, evaporation, and transpiration. Through precipitation, water moves from the atmosphere to the earth's surface in the form of rain, sleet, snow, or hail. Water that ends up on land can return to the atmosphere either by evapotranspiration (water traveling through plants to the leaves where it is released to the atmosphere) or evaporation. When evaporation occurs, water not only moves, but also changes form—liquid water becomes water vapor. Water that flows over the surface may become runoff that directly feeds receiving waters, such as estuaries, lakes, ponds, rivers, streams, and marshes, or it may seep down through the soil as groundwater. Some of the water that enters the soil becomes available for use by plants. Only about two percent of the water taken up by plants is used in photosynthesis (a process where plants convert sunlight to energy or food). Nearly all of the water travels through the plant to the leaves where it is transpired to the atmosphere to begin the cycle again.

Stormwater runoff has a significant impact on the water quality of surface waters, especially in watersheds that contain large amounts of impervious surfaces (i.e., streets and parking lots, roofs, asphalt, brick, stone, and compacted soil). In urban areas, the abundance of impervious surfaces and the lack of plants prevent stormwater infiltration and evapotranspiration, generating large volumes of water runoff and increasing the probability of direct stormwater discharge into local waters thus resulting in what we call nonpoint source water pollution problems.

What Is Nonpoint Source Pollution?

Nonpoint source (NPS) pollution, unlike point source pollution from industrial and sewage treatment plants, comes from many sources. Rain or snow falling through the air starts picking up pollutants even before hitting the ground. Once landing, water that does not penetrate the ground moves over the surface, picking up and carrying away natural and human-made pollutants as it flows over rooftops, streets, parking lots, and other impervious surfaces, finally depositing pollutants elsewhere into the receiving water body. Some of these pollutants

may include: excess fertilizers, herbicides, and insecticides from farm lands and lawns; oil, grease, and other chemicals from cars and trucks; sediment from disturbed construction sites, crop and forest lands, and eroding shorelines and stream banks; bacteria and nutrients from livestock and pet wastes; faulty septic systems; and air pollution particles.

Many states report that NPS pollution remains the leading cause of many water quality problems. The effects of NPS pollutants on specific waters vary; however, these pollutants have harmful effects on drinking water supplies, recreation, fisheries, wildlife, and overall aesthetics. Scientists and environmental managers are trying to better understand NPS pollution by quantifying the contributions of stormwater runoff to the degradation of natural waters.

What Is the Latest Scientific Research on Stormwater Runoff in Massachusetts?

Impervious cover has been shown to strongly influence the quality of receiving waters and the health of aquatic habitat (Schuler, 1994, Center for Watershed Protection, 1998). The Center for Watershed Protection (CWP) has demonstrated that significant water quality impacts can result from as little as 10 percent coverage of a watershed by impervious surfaces (CWP, 1998).

The Massachusetts Office of Coastal Zone Management (CZM) has been working to develop new methods of measuring impervious area, which has traditionally been estimated by carefully tracing impervious features from aerial photography using computer-based Geographic Information Systems (GIS). This method can be time consuming and costly when measurements are being made over large areas. CZM has been working with Massachusetts GIS (MassGIS) to simplify this process by refining coefficients that reflect the average impervious surface cover for different types of land uses. For example, CZM has determined that, on average, the surface areas of commercial properties in the Parker River Watershed (northeast Massachusetts) are covered by 64 percent impervious surfaces. The impervious area coefficient for commercial properties would therefore be 0.64. In contrast, landscape features designated as cropland in the same watershed are covered by only nine percent impervious area (i.e., a coefficient of 0.09). By generating these coefficients for each land use category (Table 1), resource managers can easily estimate impervious cover over large areas by pairing them with digital land use maps available from MassGIS. However, large variability can be associated with impervious coefficients (some of the low ones have as much as 100 percent relative standard error!), either within or among different watersheds. The analyst must be aware of these uncertainties and should explicitly state the range of error with estimates relying on impervious cover analyses.

Once the impervious area is estimated, the amount of stormwater runoff can be approximated from studies that establish runoff coefficients based on impervious cover for each of the land use categories. Dreher and Price (1993) observed the relationship between runoff volume and impervious cover as:

$$Rv = 0.05 + (0.009 * \text{percent impervious})$$

Where Rv is the runoff coefficient

Table 1 summarizes the coefficients for impervious cover and runoff for each land use category.

Table 1: Impervious area coefficients and summary statistics generated for each land use category.

Land Use Category	Mean impervious area (ratio)	Rv
Cropland	0.090	0.131
Pasture	0.080	0.122
Forest	0.078	0.120
Wetland	0.055	0.100
Mining	0.067	0.110
Open Land	0.029	0.076
Participation Recreation	0.060	0.104
Spectator Recreation	0.050	0.095
Water Based Recreation	0.343	0.359
Residential I	0.454	0.459
Residential II	0.543	0.539
Residential III	0.305	0.325
Residential IV	0.304	0.324
Salt Wetland	0.016	0.064
Commercial	0.640	0.626
Industrial	0.547	0.542
Urban Open	0.311	0.330
Transportation	0.508	0.507
Waste Disposal	0.218	0.246
Water	0.029	0.076
Woody Perennial	0.154	0.189

Table 1 Note: *Residential I – multifamily, Residential II – smaller than 1/2 acre lots, Residential III 1/4 to 1/2 acre lots, Residential IV – larger than 1/2 acre lots.*

How About an Example?

Let's look at two contrasting sub-watersheds in the larger Boston Harbor Watershed—an urban watershed and a protected Area of Critical Environmental Concern (ACEC)—to illustrate the importance of land cover on how water moves through the watershed and into its ultimate receiving waters. The Weir River ACEC is largely an open-space and low-density residential area occupying approximately 950 acres in the southern portion of Boston Harbor. This ACEC represents diverse wetland habitats that include salt marsh, shallow marsh meadow, shrub marsh, and wooded swamp (Urban Harbors Institute, 2002.). In contrast, the Weymouth Fore River is mainly a dense residential urban sub-watershed located in the southwest portion of Boston Harbor.

The Weir River ACEC is estimated to contain about six percent impervious cover, while the Weymouth Fore River sub-watershed contains about 36 percent impervious cover. Recall that 11.1 billion gallons of water were delivered to the greater Boston Harbor watershed by the 2.25-inch rainstorm that occurred on June 6-7, 2002. Using the coefficients derived above for impervious cover and runoff, stormwater runoff from the Weir River ACEC and the Weymouth Fore River sub-watershed for that same June rain event were estimated as approximately 3.5 (± 1.3) and 152 (± 24) million gallons of stormwater respectively. While the Weymouth Fore River is about 10 times greater in surface area than the Weir, it generated about 40 times more stormwater runoff (that is, about 4 times more stormwater per unit area).

Although this methodology is somewhat subjective, it does provide a sense of the relative contribution of different land uses to the NPS pollution problem. The limitations of the methodology include: a reliance on the analyst's understanding of rainfall characteristics of the region (highly variable) and the assumptions inherent in the coefficients for impervious cover and runoff; the oversimplification of the watershed hydrologic response; and the lack of procedures that measure the uncertainties associated with the model's outcomes and the appropriate field monitoring data for validating model predictions.

Stormwater that runs over lawns, roads, parking lots, and other surfaces ultimately runs to the nearest water body, including the Parker River (left) located within an Area of Critical Environmental Concern.

Conclusions

Given continued water pollution problems, governments at all levels are recognizing NPS pollution prevention and control as vital to water resource protection. Impervious surfaces are viewed as one of the most problematic factors leading to the degradation of watershed receiving waters by stormwater runoff. Measures taken to control stormwater runoff pollution from impervious surfaces may be an important next step to ensuring the protection of groundwater, marshes, streams, rivers, lakes, estuaries, and coastal waters.

In urban watersheds, 30-60 percent of the ground cover may be impervious. The methods for estimating stormwater runoff based on impervious cover of land categories is used to illustrate the importance of land cover types in the retention of rainwater among watersheds. However, model-based estimates are only a starting point for more efficient watershed planning, pollution prevention and control implementation, and habitat protection and restoration.

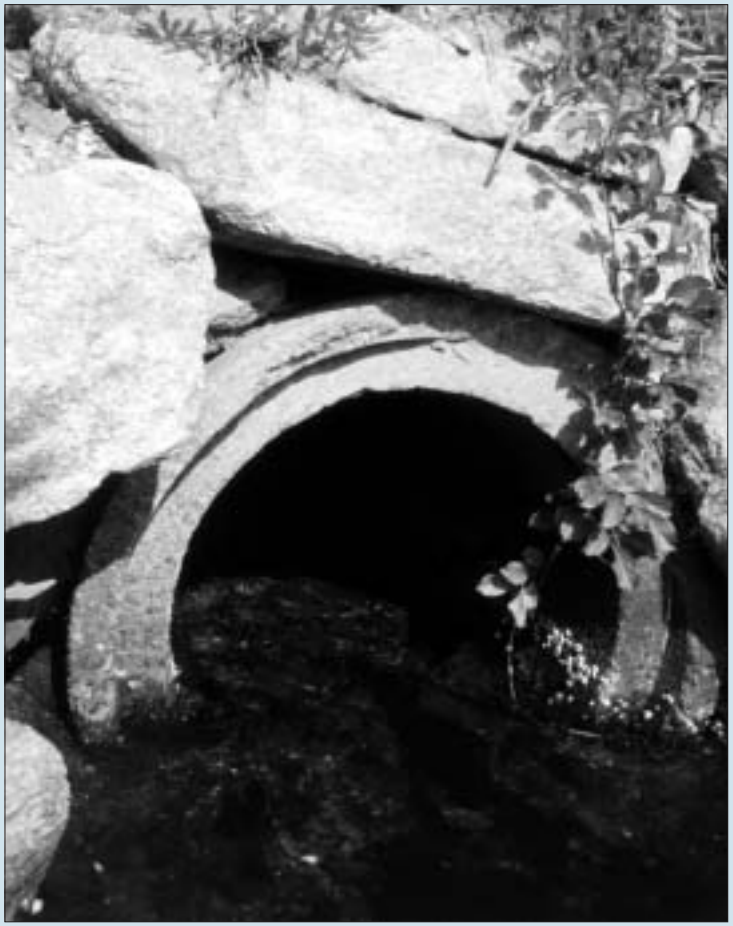


photo by Bruce Carlisle

photo by Bruce Carlisle

Impervious surfaces, including parking lots, asphalt, and compact soil, are abundant in urban areas.

References

Center for Watershed Protection (CWP). 1998. *Rapid Watershed Planning Handbook: Comprehensive Guide for Managing Urban Watersheds*. Ellicott City, MD.

Dreher, D., and T. Price. 1993. *Application of urban targeting and prioritization methodology to Butterfield Creek, Cook and Will Counties, Illinois*. In EPA/625/R-95/003, Seminar Publication: *National Conference on Urban Runoff Management: Enhancing Urban Watershed Management at the Local, County, and State Levels.*

Schuler, T. 1994. *The Importance of Imperviousness. Watershed Protection Techniques* 1(3):100-111.

Urban Harbors Institute, 2002. *Weir River Area of Critical Environmental Concern: Natural Resources Inventory Report to the Masssachusetts Executive Office of Environmental Affairs.* 70 pp. (also available at www.uhi.umb.edu/pdf_files/weir_acec_nri_report.pdf.)

U.S. EPA Office of Water. 1992. *Environmental Impacts of Stormwater Discharges: A National Profile*. EPA 841-R-92-001.

Marion, Massachusetts: Land of Many Waters

By Arden Miller, CZM

During the summer months, many sailboats dock in Sippican Harbor.

Sixty miles to the southeast of Boston, facing the Atlantic, lies Marion, Massachusetts. The 14-square mile town on Buzzards Bay is inhabited by just over 5,000 people during the winter, but in the summer months this number swells to more than 10,000. Many claim its harbor—known as Sippican Harbor on the nautical charts—is the prettiest in the Bay. During the summer months hundreds of small sailboats dot the harbor, giving it a quaint, picture postcard, timeless look that appeals to residents and visitors alike.

Also lending to the picturesque look of this coastal community are the well-preserved, still functioning historical buildings. While many no longer serve their original function—what was a place of worship from 1799 to 1841 is now Marion General Store and the former site of the Universalist Church is now home to the Marion Art Center—original architectural details abound, especially in the magnificent homes built between 1815 and 1890 by wealthy sea captains. A well-known early landmark, Handy's Tavern, was built in 1812. A short walk from the dock, the tavern was once the watering hole for the many sea-faring men in search of spirits. Today it is the headquarters for the Sippican Woman's Club and is only operated as a tavern for special occasions.

One such "special occasion" took place on May 14, 2002, when the townspeople commemorated Marion's 1852 break from Rochester. Originally, Mattapoisett, Rochester, and Marion were collectively known as the Town of Rochester. Due to on-going arguments as to where the Town meetings were to be held, as well as larger issues around money and property, Marion petitioned the State House and the Legislature made Marion a separate town. Once incorporated, the town's first task was to choose a name. Rather than keeping the Native American name Sippican (meaning "land of many waters"), they named the town Marion in honor of Revolutionary War hero Francis "Swamp Fox" Marion (we can only speculate that the residents of that era didn't think Swamp Fox, Massachusetts had the right ring to it).

In the sailing world, Marion is known internationally, as sailors from around the world are familiar with the biennial odd-years-only Marion-to-Bermuda Yacht Race (please visit www.marionbermuda.com for more information).

But perhaps the most famed association with Marion is the ghost of the sailing ship the *Mary Celeste*. The 100-foot brigatine of 282 tons was from Marion. In 1872, on the way to Genoa, Italy, by way of the port of New York where the ship was cargoed with 1,700 barrels of raw alcohol, something went awry. A number of theories exist—everything from fumes from the alcohol causing the crew to hallucinate and jump overboard to piracy to the ship running aground on a moving sandbar to a swimming contest off the bow into shark infested waters—but nothing has ever been conclusively concluded. What everyone familiar with the available details *does* agree on is this: the ship's last log, recorded days after they set sail, is dated November 24 and that, for some reason, on November 25 she was abandoned and none of the 10 people on board were ever found. How that came to happen is a mystery on which the living can only speculate. But the real mystery that holds intrigue for many marine historians is that, somehow, the *Mary Celeste* sailed herself, for 10 or 11 days (records vary on this count) across the Atlantic. Was it a ghost? An inexplicable convergence of wind and water conditions? When discovered by the captain of the *Dei Gratia* (a bark sailing from New York to Gibraltar), the ship was in first-class condition with hull, sails, and mast all sound and in place. There was plenty of food and water on the ship and the cargo-barrels of alcohol were still lashed in place in the hold. What's most astonishing is that the sails were set to catch the wind coming over the starboard quarter, meaning that they had been completely re-positioned since leaving the Azores 10 days earlier.

Official explanations by the British and American authorities at the time suggest that the crew got at the alcohol, murdered the captain, and escaped to another vessel. But seeing as there were no signs of a visible struggle, and the alcohol was still in place, it seems unlikely that the ship fell prey to foul play. More recently, it was surmised that a known earthquake was recorded around the time *Mary Celeste* was abandoned, frightening the crew enough to cause them to jump overboard.

We'll never know for sure what happened to the "ghost ship" from Marion, but if you're looking for history, colonial buildings, and a land of many waters, Marion is the place to go!

For more information on Marion

www.townofmarion.org

On the mystery of the *Mary Celeste*

www.occultopedia.com/m/mary_celeste.htm

Scenes in scenic Marion: the park (above) and the General Store on Main Street.

all photos by Bob Gass

CoastalTrails

Back Forward Stop Refresh Home AutoFill Print Mail

Address: http://www.state.ma.us/czm/coastaltrails.htm

Preview Your Next Coastal Trail on the Web

By Brian Mardirosian and Anne Donovan, CZM

From the comfort of your desk chair, you can sample some of the coastal trails the Commonwealth has to offer. Here's a selection of some of the places you'll find...

photo as seen on web site

Self-Guiding Nature Trails, Cape Cod National Seashore

www.nps.gov/caco/activities/images/Self-gui1.pdf

This online brochure from the National Park Service highlights 11 trails found throughout the Cape Cod National Seashore. It provides specifics about the length and location of each trail, as well as some of the features you will find. Labeled "self-guiding," most of these trails include interpretive information about items of interest along the way.

Boston Harbor Islands

www.bostonislands.com

Only minutes by sea from downtown Boston, the Boston Harbor Islands are a natural, historical, and cultural treasure that are both remote and highly accessible. This site offers abundant information, including a trip planning guide to this unique state park and National Park Area, which includes 34 islands situated within Boston Harbor and inner Massachusetts Bay. Ferry service is available from downtown Boston and the South Shore throughout the summer season.

Wellfleet Bay Wildlife Sanctuary

www.wellfleetbay.org/nature.html#trails

Descriptions and highlights of five main trails at the Wellfleet Bay Wildlife Sanctuary are provided on this site, along with information about the butterfly garden. Visitors can wander over boardwalks, along salt marsh and tidal flats, by ponds, through woodlands, and over a sandplain grassland.

photo as seen on web site

Parker River National Wildlife Refuge

http://parkerriver.fws.gov/

Located on Plum Island, this refuge is famous as a birders' paradise. This Web site provides a description of the refuge, detailed information about what to do and see, and maps of the area. While exploring one of the four nature trails you can easily spot waterfowl, raptors, shorebirds, and many of the other avian residents and visitors to the island.

World's End

www.bostonislands.com/worldsend.html

World's End, owned by the Trustees of Reservations and now part of the Boston Harbor Islands National Park Area, has been used by humans since pre-historic times. As described on this Web site, you can walk along several miles of paths and carriageways designed by Frederick Law Olmsted and enjoy the 360-degree view from the top of Planter's Hill.

Lloyd Center

www.thelloydcenter.org/activities/trails.htm

Five trails wander over 55 acres of maritime forest on the edge of an estuary in South Dartmouth. This site provides a map and brief descriptions of the interesting things you will find along the way when wandering through this diverse area, which includes wildflower, swamp, forest, and riverside trails.

image as seen on web site

Check out the Massachusetts Office of Coastal Zone Management Web site at **http://www.state.ma.us/czm/coastaltrails.htm** for connections to more coastal trails.

Local machine zone

Ask Joe

By Arden Miller, CZM

Often referred to within the Massachusetts Office of Coastal Zone Management (CZM) as the "institutional memory" of the agency, Joe Pelczarski is the recipient of a wide array of questions and requests. During the 21 years he's worked at CZM, he has served on committees responsible for a wide range of issues. Between the phone and various committee roles, he has seen and heard it all. Here he shares some of the more unusual situations and questions that have come up over the years...

What is the most unusual thing you've ever had to do for your job?

Other than answering random questions on the phone?! Well, the three-week trip I took to the Grand Banks and Flemish Cap in 1982 would rank up there. I was an observer on a swordfish boat that went into waters beyond our (CZM) jurisdiction and a memo I wrote during the trip ended up being excerpted in Sebastian Unger's *The Perfect Storm*. Another "not your normal work day" experience I had was being filmed as a clam digger for a public service announcement in the early '90s. I spent the whole day digging up clams. They used the footage, but I don't think it got much air time because it was competing with an announcement the New England Aquarium did on whales, which was a little more exciting than me digging clams...

What stands out as something you were asked to do that had nothing to do with what you were hired to do?

The Massachusetts Emergency Management Agency asked me to mediate between the Highway Department and the Natural Heritage Program to figure out an appropriate water level for a dam. The issue was that the dam was holding too much water back and the water flooded the roads, creating dangerous driving situations. Releasing too much water would place endangered turtles that were hibernating at risk by being exposed to freezing temperatures. My role pretty much came down to me saying to both parties: "Pick a water level here that you can both live with and let's move on!"

What's the oddest question you've ever been asked?

A reporter from out-of-state—somewhere in the midwest, I think—called during a storm to ask me to confirm that Cape Cod was sinking into the sea. I told the reporter that all was well and that any reports of Cape Cod's sinking were greatly exaggerated. (I did, of course, explain about sea level rise.)

And what's the strangest project to come up for review by CZM?

Well, in the early '80s an interesting proposal came into CZM for Project Review. (Editor's note: projects that need federal permits are reviewed by the CZM office for their consistency with state environmental policies.) This gentleman wanted to build a platform 20 miles from Boston called Gugels Island. His idea was to provide citizens with the pleasures of life that are not legal on-shore: a gambling casino, a brothel, off-shore banking, et cetera. He wanted us to sign off on this project that would create this big time floating party that would be visited by boaters and cruise ships. Maybe he was ahead of his time, but we didn't sign off on that.

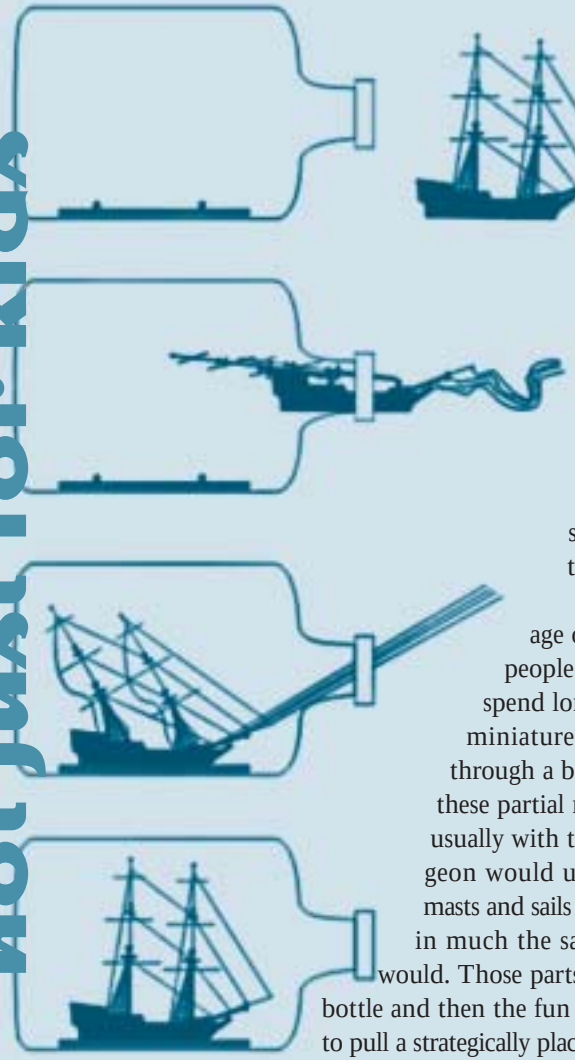
Last question: what's the funniest thing you've ever been asked?

To do the 'Ask Joe' column!

Joe as he appeared in a public service announcement on the importance of clean shellfish beds.

The Ancient Art of Building Ships in Bottles

By Arden Miller, CZM



If patience is a virtue, then the early ship-in-a-bottle builders are among the most virtuous citizens in recorded history. The average opening in a glass bottle is less than an inch, a circumference that is far too small for much of anything to fit into, let alone a fully constructed model ship. So how do those ships get into bottles? Do they build the bottle around the ship? Is there a special way to make the bottom come off so that a ship can be put into the bottle and then the bottle can be re-sealed?

While it's difficult to imagine in an age of instant coffee and instant messaging, people used to—and in some cases still do—spend long hours carefully constructing pieces of miniature ships that were small enough to fit through a bottle's opening. Once inside the bottle, these partial minis were very carefully fitted together, usually with the type of tweezer-like tools that a surgeon would use in a delicate operation. The mini masts and sails would be created using cloth and rigging in much the same way their life-sized counterparts would. Those parts were painstakingly attached inside the bottle and then the fun part—the lilliputian ship's captain gets to pull a strategically placed string and raise the sails. Because of all this very exacting work, these creations are also known as "patience bottles" and can literally take hundreds of hours to complete.

With origins believed to date back to the 1700s—the earliest dated ship-in-a-bottle was created in Sweden in 1781—examples of original, hand-crafted bottles can be found in museums, including the Smithsonian in Washington, DC, the South Street Seaport Museum in New York City, and the Mariners' Museum in Newport News, Virginia. Most often, they were made by people, such as lighthouse keepers, sailors, prisoners, insane asylum inmates, and people in religious orders who had the time and required patience for such endeavors.

There are still some patient people who construct ships-in-a-bottle in the same manner that they were made 200 years ago. Hobby clubs devoted to this art can be found in most states. If you are interested in spending some serious time creating this form of folk art, you might want to start by getting some tips from someone who's been through the process already or buy a book on the subject. But, if you're more interested in having a ship in a bottle constructed from pre-made parts that come with specific instructions than building one from scratch, you can buy a kit at a hobby store or online. Please refer to the following sites for more information:

BOOKS
www.aquabooks.com/aquabooks/boating/shipmodeling.shtml

EXAMPLES OF PROFESSIONALLY BUILT SHIPS IN BOTTLES
www.shipbottle.by.ru/english/gallery/

TIPS FOR PEOPLE BUILDING SHIPS FROM SCRATCH
http://hometown.aol.com/mrx3010/bottled.html

LOCATIONS OF HOBBY CLUBS
http://home.att.net/~ShipModelFAQ/smf-q100.html

BUILDING KITS FOR SALE
http://shop.store.yahoo.com/marinersmuseum/amshipinbotk.html

The "Harbour" in the town of Boston (background, c. 1800) remains an important economic conduit for Massachusetts.