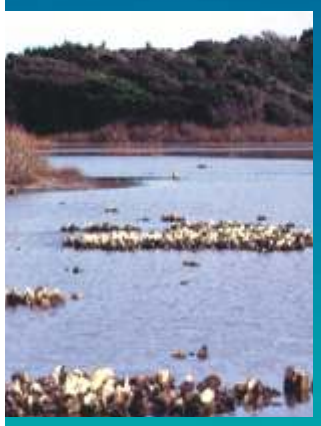

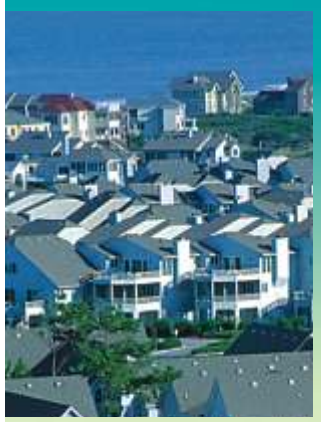

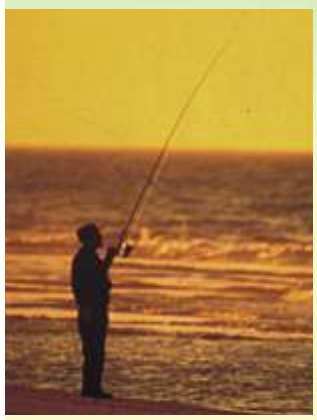

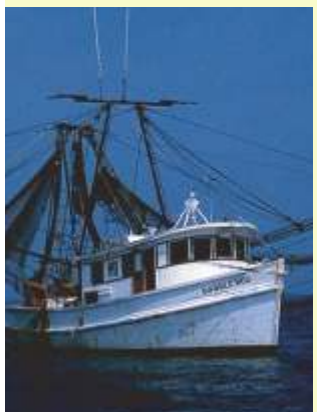

North Carolina's Coastal Habitat Protection Plan

NCDENR

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THANKS

This publication was produced by the North Carolina Department of Environment and Natural Resources with funding provided by the National Oceanic and Atmospheric Administration as part of an effort to inform the public about the Coastal Habitat Protection Plan. The following people advised the department on the public-relations effort. We thank them for their time and support.

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A Habitat Is A Home

This publication is all about habitats, those special places along our coast that are critical to the survival of marine fisheries. As you read the pages, you will learn about wetlands, estuaries, plants and wildlife.

I look forward to working with you to protect our coastal habitats and all the state's valuable resources.

Almost half of the fish harvested in the United States are caught within three miles of shore. More than 90 percent of the fish and shellfish that support our state's billion-dollar commercial and recreational fishing industries spend at least part of their lives in our sounds and coastal waters. These coastal waters are the most productive part of the ocean, and they must be protected.

Our legislators recognized this need in 1997 when they passed the Fisheries Reform Act. A provision in the law requires North Carolina's major environmental regulatory commissions to adopt plans to protect and even enhance marine habitats. Drafting the first Coastal Habitat Protection Plan (CHPP) is also under way. The goal of this overall process is to identify critical habitats and recommend ways to sustain and improve them. Much of the needed work has been completed, but more lies ahead.

You can assist in this effort, and your involvement is encouraged. North Carolina can and will become a national leader in protecting wetlands, spawning areas, threatened and endangered species habitat, fish and shellfish nurseries, and outstanding resource waters. Your participation and support will help us achieve these important objectives.

Michael F. Easley, Governor

Working Together to Protect Special Places

North Carolina is home to a tremendous variety of fish and shellfish largely because the state has such a great diversity of habitat where those animals feed, spawn and grow. About 2.5 million acres of coastal and marine waters are spawning and nursery grounds for most of the state's important fish species and many that migrate along the East Coast.

Commercial and recreational fisheries contribute a billion dollars a year to the economy of North Carolina and have long been considered an inexhaustible resource. Even though the state is among the top-10 seafood producers in the country, increasing pressures on coastal and marine habitats, including habitat loss and degradation and poor water quality, have jeopardized our fisheries.

Important fish habitats provide the basic needs of fish and shellfish, including food, shelter, and places to reproduce and grow. The N.C. coast includes almost 4,000 miles of estuarine shoreline, with a wide range of habitats. Whether it is a freshwater swamp, a salt marsh or a mud flat, these habitats all play a vital role in sustaining our fisheries.

AMBITIOUS GOAL

State legislators, recognizing the need to protect such special places, passed the Fisheries Reform Act in 1997. The law contains the directive to protect and enhance coastal habitats that are critical to coastal fisheries. To achieve that ambitious goal, the law requires the cooperation of three state regulatory commissions. The Environmental Management, the Coastal Resources and the Marine Fisheries commissions must work together to prepare and adopt a plan to protect and restore these critical habitats and to implement the plan. The commissions also must ensure that they act in a manner consistent with the adopted plan.

The N.C. Division of Marine Fisheries has been assigned the task of formulating what's known as the Coastal Habitat Protection Plan, or CHPP. It has been working since 1999 with several other state and federal agencies on the framework of the plan, a sort of broad-brush examination of the six critical marine habitats coast-wide. That CHPP is the subject of this publication. Later components of the plan will be more specific, examining those habitats in 11 geographic regions that closely follow coastal watershed boundaries.

WHAT IS A CHPP?

The CHPP will be a rather detailed document that describes the habitats and includes scientific information on their ecological function and importance to marine fisheries. It will also identify the threats to each habitat and recommend needed research and regulatory steps that should be taken to protect and enhance each habitat.

Those habitats will be described in greater detail later in this publication, but briefly they are:

- ***Water column:*** The water in a river, sound or ocean and its physical, chemical and biological properties.
- ***Shell bottom:*** Intertidal and subtidal bottoms made up of shells or living oysters, clams or other shellfish.
- ***Submerged aquatic vegetation:*** Underwater beds of rooted plants, called sea grass, or macroalgae.
- ***Wetlands:*** Areas that are inundated enough to support plants normally adapted to saturated soils.
- ***Soft bottoms:*** Sand and mud bottoms with no vegetation.
- ***Ocean hard bottom:*** Exposed areas of rock or hard sediment in the ocean.

THE CHPP PROCESS

Drafting of the CHPP is now under way. Two representatives of each of the three regulatory commissions sit on an oversight board called the Intercommission Review Committee that will review and modify the draft plan. The public will also have an opportunity to review and comment on the plan at a series of public meetings this summer.

The more specific watershed plans haven't yet been scheduled. All the plans are supposed to be updated every five years.

CHPP TIMELINE

1997

- General Assembly passes the N.C. Fisheries Reform Act, which includes a provision to prepare Coastal Habitat Protection Plan (CHPP).

1998

- N.C. Department of Environment and Natural Resources establishes a CHPP Development Team to provide technical guidance.
- The three responsible regulatory commissions establish the Intercommission Review Committee to work with CHPP team on the plan.

1999

- The N.C. Division of Marine Fisheries (DMF) establishes a Habitat Protection Section to develop a coast-wide plan.

2000

- The CHPP staff begins drafting the coast-wide plan. The N.C. Department of Environment and Natural Resources (DENR) changes the plan's format in 2001 and 2002.

2001

- CHPP Public Outreach Committee meets to discuss DENR's outreach efforts.

2003

- DENR begins pubic outreach by producing a CHPP video, brochure and tabloid and by sponsoring public meetings.

2004

- Draft coast-wide plan is the subject of another round of proposed public meetings before the regulatory commissions adopt the final plan in the fall.

Do Your Part GET INVOLVED!

YES! I'd like to get involved with protecting coastal fish habitats.

- ❑ Put me on the CHPP mailing list
- ❑ Send my organization a CHPP video.

Name

Affiliation

Mailing Address

City

State Zip

Phone

Email Address

Please mail or fax this form to:

CHPP
N.C. Division of Marine Fisheries
PO Box 769
Morehead City, NC 28557
Fax: 252-727-5127

CHPP Contacts

For more information on CHPP, contact:

N.C. Division
of Marine Fisheries
PO Box 769
Morehead City, NC 28557
252-726-7021 or 800-682-2632
Email: *CHPPS@ncmail.net*
Web: *www.ncfisheries.net*

Get Hooked On CHPP

As you will read later, protecting and restoring habitat are important to the survival of shrimp and flounder and dozens of other marine creatures. You won't, however, read much about the ultimate beneficiary: You.

People tend to get overlooked in these sorts of plans to protect and restore the environment. Oysters and shrimp may grab the headlines, but rest assured we are the final victims if these special places disappear.

At stake, of course, are North Carolina's billion-dollar commercial and recreational fishing industries. But that's just money.

How much poorer would our imaginations be without periwinkles clinging to salt marsh grass, without the great blue heron stalking an oyster bed at low tide, without hooded pitcher plants glistening with the morning's first dew? All are parts of the astounding whole that we call the North Carolina coast. All would be diminished if just one of the parts was lost.

So whether you have the heart of a poet or just like fried flounder for supper, you have something to lose here. It's reason enough to get involved, to make sure the periwinkles will have their salt marsh and you will have a flounder supper.

There are several ways you can get involved to ensure that the Coastal Habitat Protection Plan is adopted and its recommendations carried out. Learn as much as you can about the plan and the process meant to develop it. Visit the North Carolina Division of Marine Fisheries' Web site or fill out the form elsewhere on this page to be put on the CHPP mailing list. If you are a member of a group, you may even be able to get a copy of a video to show other members.

Attend one of the public meetings this summer. You'll have an opportunity to hear from those who are drafting the plan and comment on what you would like to see included.

We want to hear from you, and we will be listening.

Attend A Public Meeting

All meetings begin at 7 pm. For more information please call the CHPP office at 252-726-7021 or 800-682-2632.

Wednesday
July 23, 2003
NC Museum
of Natural Sciences
Raleigh

Thursday
July 24, 2003
Mooresville Citizens Center
Mooresville

Tuesday
July 29, 2003
Brunswick Electric
Membership Corporation
Supply

Wednesday
July 30, 2003
Northeast Branch of
New Hanover County Library
Wilmington

Tuesday
August 12, 2003
Dixon High School
Holly Ridge

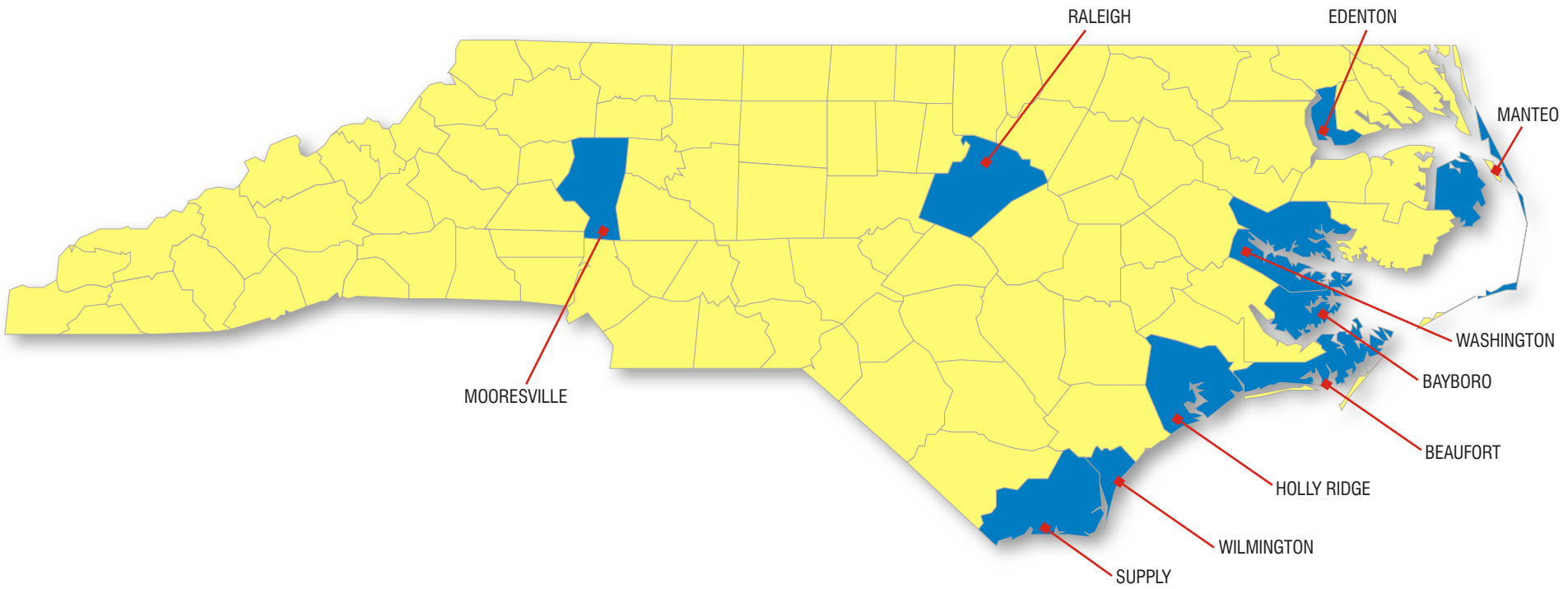
Wednesday
August 13, 2003
East Carteret High School
Beaufort

Tuesday
August 19, 2003
N.C. Aquarium
Manteo

Wednesday
August 20, 2003
Town Council Chambers
Edenton

Tuesday
September 9, 2003
N.C. Estuarium
Washington

Wednesday
September 10, 2003
Pamlico County High School
Bayboro



Red Drum
Sciaenops ocellatus

Description: Chin without barbells; copper bronze body, lighter shade in clear waters; one to many spots at base of tail (rarely no spots); mouth horizontal and opening downward; scales large.

Where Found: In coastal and estuarine waters from Massachusetts to Mexico, feeding along the bottom for crabs, shrimp, menhaden, mullet and spot.

Size, Age: Can live for more than 60 years and weigh as much as 90 pounds.

State Record: 94 lbs, 2 oz, caught on Hatteras Island in 1984.

Life Cycle: Large red drum live in the coastal waters of North Carolina throughout the year, often seen in the surf during the spring and fall and commonly found in the Pamlico Sound during the summer. Larval and juvenile drum use various shallow estuarine habitats in coastal sounds and rivers during the first few years of life. Upon maturity, red drum move out of the estuaries to join spawning adults in the ocean. Most red drum reach sexual maturity during their fourth year, when they are about 30 to 37 inches long. They spawn around the coastal inlets and in some areas of Pamlico Sound during the fall. Their eggs hatch in 24 hours and are carried throughout the sounds and estuaries by the tides and winds. The larval drum seek quiet, shallow water with grassy or muddy bottoms.

Cool Facts: Red drum get their name from their color and the fact that during spawning time, males make a drum-like noise by vibrating a muscle in their swim bladder. The N.C. General Assembly designated the red drum as the state fish in 1971.

Average Commercial Landings, 1992-2001: 201,055 lbs.

Average Recreational Landings, 1992-2001: 255,884 lbs.

Stock Status: Overfished. One indication that a population of fish may be in trouble is if there are not enough mature fish to continue producing young fish at a consistent level.

Water: The Lifeblood of Our Coastal Ecosystem

Scientists have counted about 130 species of fish in North Carolina's coastal rivers and sounds and in the ocean just offshore. The water is their home.

Of the six critical marine habitats you will read about on these pages, water is clearly the most important. To call it the lifeblood of our coastal ecosystem wouldn't be a stretch. All those other habitats wetlands, sea grass beds, shell bottoms and the like depend on water. It sustains them and the marine creatures that rely on them.

This watery habitat is also very different from the others on these pages. It can't be dredged or filled or paved over. It can't be pulled up, knocked down or depleted. The water that fills our coastal rivers and sounds or breaks against our beaches just won't disappear one day. Yet, it can be changed, sometimes to the point that it is of little use to the fish and shellfish that depend upon it for life, or to the people who consume seafood. Our treated sewage and industrial waste that we discharge, for instance, may alter the waters, change its salinity or temperature or add toxic chemicals. Or maybe we damage nearby wetlands and forests, replacing them with roads, parking lots, lawns and subdivisions, which shed runoff from the land into the water.

Runoff may make the water so muddy sunlight can't penetrate it. The seagrasses that grow in the shallows will be less abundant or worse yet may die. Scallops can't live without seagrass beds. Baby croakers, flounder and trout will no longer have good places to hide, and become easy prey to larger fish looking for dinner.

Seafood caught in polluted waters may not be safe to eat. And health advisories warning us not to swim in the ocean, sounds, and rivers now appear in more and more places after each major rainfall.

While water may be the lifeblood of our coast, the pollutants that can foul it are like bad cholesterol that clogs arteries and robs us of life.

THE BENEFITS

That all marine organisms need water to survive is an obvious fact. But not any old water will do. Most creatures need water that is within a particular temperature or salinity range or has a certain concentration of dissolved oxygen. Some require fast-moving currents, while others prefer the stillness of backwater bays. Often, their requirements change during their lives.

Blue crabs, for instance, spend most of their lives in shallow estuaries, where they can tolerate a wide range of salinities and temperatures. A female crab, though, must make her way to the inlets to lay her eggs because her larvae need high-salinity waters to survive. Striped bass, blueback herring and other types of anadromous fish spend their lives in the ocean, and make annual spawning runs up freshwater rivers.

Water temperature triggers those spawning runs – striped bass and herring begin the runs when the water reaches about 57 degrees. Temperature, in fact, is one of the key factors that determine where marine creatures live at various times in their lives. The adults of most species can tolerate wide temperature fluctuations, but their young have more specific needs. Adult clams, for instance, can live in water from 0-95 degrees. Their larvae, however, will die if the water temperature drops below 63 degrees or rises above 84 degrees. Striped bass eggs won't survive in water much below 54 degrees.

Water flow and clarity, dissolved oxygen, and acidity are other critical factors that determine where fish go to eat, spawn or use as a nursery for their young.

THE TRENDS

There have been warnings since the late 1980s that our coastal waters are becoming degraded. Fish kills, algal blooms, increased shellfish-harvest closures, more prevalent marine diseases and prolonged periods of oxygen-depleted water – called “dead water” by the fishermen – are signs that this watery habitat is out of balance.

Declining commercial fish catches can also be a hint that all is not right in the water, although pollution isn't the reason for some of the declines. Depressed catches of some species may be due to natural fluctuations, overfishing or adverse weather conditions. However, studies show that habitat loss and water-quality problems have led to precipitous declines in river herring and other anadromous fish.

THE THREATS

Stormwater runoff is now the largest source of pollution of coastal waters. Runoff increases dramatically when the land is cleared and covered with pavement, driveways, rooftops and other hard surfaces. With the runoff come fertilizers and pesticides, grease and oil, bacteria and nutrients. They can have a devastating effect on the water, even in a relatively rural water basin. In the White Oak River basin, for instance, almost 31,000 acres of shellfish waters have been impaired because of bacteria contamination from runoff. Urban land cover in the basin has increased more than 82 percent since 1982.

Nutrients, such as phosphorus and nitrogen, from agricultural runoff and sewage plants can lead to algal blooms, which can lead to fish kills.

Dams, culverts, and ditches can divert or restrict water flow, keeping fish from reaching spawning grounds or preventing their eggs from hatching.

Wetlands: The Sinks and Faucets of the Coast

William Byrd led the surveying party that ran the North Carolina-Virginia state line through the Dismal Swamp in 1728. Byrd summed up what most settlers of the North Carolina coast thought of the region's vast stretches of marshes, swamps and bogs.

"Never was rum, the cordial of life, found more necessary than it was in this dirty place," Byrd wrote in his history of the survey.

What we now call "wetlands" were considered wastelands in Byrd's day. They were thought to be unhealthy and, thus, were avoided and given names like "Dismal." The only good swamp, Byrd and his contemporaries concluded, was a drained one.

That idea held until rather recently. The most productive use of a swamp or marsh, it was thought, was as a soybean field, a housing development or a shopping center.

We now know and understand more about wetlands, of course. We know, for instance, that an acre of salt marsh can be more productive than an acre of corn, and we understand that without wetlands our coastal sounds and rivers wouldn't support the abundant sea life they do now.

THE BENEFITS

Generally, a wetland is an area that is flooded by water frequently enough to support plants that live in wet soil. Along the coast, the definition embraces such diverse ecosystems as salt marshes that fringe the sounds to inland shallow depressions that periodically fill with rainwater.

Each type of wetland is important in keeping our sounds and coastal rivers healthy. The salt marshes, for instance, provide food and sanctuary to countless creatures, from marsh periwinkles to Canada geese. Young blue crabs, the state's most important commercial fishery species, use the marsh as a haven from predators. The crabs also feed on plant-eating snails and keep them from overgrazing on the grasses.

The large expanses of shallow water and thick vegetation found in wetlands provide abundant food and cover for the young of numerous marine creatures. The marshes are the nursery for such important species as cobia, red drum, southern flounder, striped mullet, and shrimp.

Inland, wetlands trap storm water long enough to allow pollutants and debris to settle out before reaching the sounds. Such wetlands also help recharge freshwater aquifers that so many residents depend on for their drinking water.

Many wetlands are important natural areas, supporting rare plants and animals. And scientists are just beginning to understand how wetlands help filter water. They are the sinks and faucets in the coastal plumbing system – holding water or slowly releasing it into the sounds.

THE TRENDS

Our eyes tell us that much of our coast is covered in wetlands. Scientists have tried to be more precise. Based on maps of the state's 20 coastal counties, they estimate that there are about 2.8 million acres of wetlands along the coast. Salt marsh covers about 198,000 acres and is the type of wetland considered most critical for marine species. Pamlico, Core and Bogue sounds and the areas along the southern coast have the largest expanses of salt marsh.

Bottomland hardwood forests and river swamps, two other types of wetlands, are found most frequently in the Chowan, Roanoke, Tar/Pamlico, Cape Fear, and Neuse river basins, while freshwater marshes are more common along the Cape Fear River.

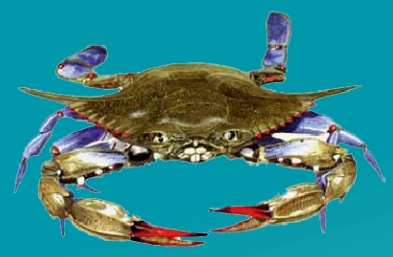
Determining the health of the state's wetlands is a tricky question, and the answer depends on who's doing the assessing. Some studies estimate that North Carolina originally had about 7.2 million acres of wetlands, with about 95 percent in the Coastal Plain. Others estimate that North Carolina had 11 million acres before the arrival of European settlers.

THE THREATS

Millions of acres of wetlands have been filled, drained or altered since colonial times. Some were drained just to control mosquitoes. Many more were cleared, drained and filled for residential and commercial development or for cropland and tree farms. On the peninsula between Albemarle Sound and the Pamlico River alone 600,000 acres of wetlands may have been lost, mostly for large corporate farms. In a tabulation done in 1994, the state estimates that almost 500,000 acres of wetlands critical or beneficial to marine species have been destroyed or compromised.

Thankfully, the uncontrolled draining and filling has stopped, but wetlands continue to be lost. The state estimates that about 100 acres of wetlands are allowed to be filled and drained in the coastal counties each year. That doesn't account, though, for wetlands destroyed by erosion, by illegal filling or by projects too small to require permits. Some permits that allow wetlands to be destroyed or damaged also require that they be replaced by wetlands that are created or restored, resulting in a theoretical net gain. These "new" wetlands, however, may not work as well as the ones that were destroyed or may be in different watersheds.

Building bulkheads or armoring shoreline with rock and rubble can also increase erosion of the marshes that fringe the water.



Blue Crab
Callinectes sapidus

Description: An olive-green and white crustacean, which like its cousins the shrimp and the crayfish, has 10 legs. It gets its name from the color of the males' claws.

Where Found: A major predator in sounds and coastal rivers from Nova Scotia, throughout the Gulf of Mexico to northern Argentina.

Size, Age: Can live seven to eight years and grow to 7 inches.

Life Cycle: Blue crabs mate in brackish waters between March and October, peaking in the spring and late summer. Ordinarily, females mate only once, while they are in the soft shell state after their last molt. Males may mate any time during the last three or four molts. Females are about 1½ years old when they mate and will store the sperm for use in two or more spawnings during the rest of their lives. After mating, the females migrate toward inlets where the salinity is higher and release up to two million eggs. Only one in a million will reach adulthood. Once hatched, the young crab goes through a complex transformation from zoeae, when it is part of the oceanic plankton and drifts for 40 days or more; molting through the megalopa stage; and finally to the first crab stage.

Cool Fact: The scientific name given to the blue crab was derived from Latin and Greek: *Calli,* beautiful; *nectes,* swimmer; and *sapidus,* savory. Thus, a literal transition might be "the beautiful savory swimmer." Another translation: "The beautiful swimmer that's also savory to eat."

Average Commercial Landings, 1992-2001: 50,030,921 lbs.

Average Recreational Landings, 1992-2001: Unknown

Stock Status: Concern. Significantly reduced commercial landings of blue crabs for 2000 and 2001, following the historically record high landings during 1996-1999, have some worried about the health of the fishery. Researchers think that harvest may be near its maximum sustainable yield which is the most that can be caught in a given year.

Underwater Grasses: Gardens Nurture Young of Many Species

Atlantic Bay Scallop
Argopecten irradians

Description: The name "scallop" aptly describes the fluted edges of the fan-shaped shell. The shells of young scallops, in particular, are beautiful; the outside is delicately colored, sometimes with pink and white or other darker variations. The inside of the shells are pearly white and have a satiny luster.

Where Found: Only in sounds and bays from New England to Texas, usually on muddy sand in sea grass beds.

Size, Age: Reaches a maximum size of 4 inches and can live for about two years, although very few live more than about 15 months in North Carolina because of the high summer water temperatures.

Life Cycle: Spawn in fall and in late spring when water temperatures reach about 60 degrees. The larvae go through several swimming stages before attaching to the leaves and stems of sea grass. Bay scallops are filter feeders, eating microscopic algae. Predators of the bay scallop include the blue crab, starfish, rays and herring gulls.

Cool Fact: The bay scallop is the only bivalve that can move independently. By contracting its muscles and snapping its shells, a scallop can propel through the water in a jerky motion. It also has as many as 50 blue eyes along the inside of its shell to sense shapes and movement.

Average Commercial Landings, 1992-2001: 69,784 lbs of meat

Average Recreational Landings, 1992-2001: Unknown

Stock status: Concern. The population is highly variable and seems depressed since a major kill caused by the 1987-88 red tide.

They clean the water, provide a haven for young fish and are food for dozens of different birds and sea creatures. These small plants that grow mostly unseen beneath the water help keep North Carolina's coastal waters healthy.

THE BENEFITS

This underwater garden is an important part of the coastal ecosystem. The plants are top-notch recyclers, for instance. They take nutrients such as phosphorus and nitrogen from the sediment and release them into the water when they die.

Decomposed plant matter and its associated bacteria are actually more important food for fish than the living plant leaves. The decomposed plants are food for shrimp, bacteria and fungi, which in turn are eaten by larger animals. Geese and many kinds of ducks depend on the living leaves, roots and other parts of the plants.

More than 40 different species of fish and invertebrates have been collected from grass beds, which are busy nurseries for young croaker, spot, mullet, red drum, flounder, blue crabs and pink shrimp. Grass shrimp, spotted seatrout and weakfish spawn in the grass, and bay scallops need grass meadows to survive.

Plant beds also tend to reduce shoreline erosion by sheltering the land from waves. They also help cleanse the water, their leaves acting as screens to remove sediment.

THE TRENDS

North Carolina has about 200,000 acres of sea grass beds. Only Florida at 2.7 million acres has more along the East Coast. Recent surveys show that the beds that grow in water of high-salinity appear stable. In fact, most of the state's grass beds grow in the sandy and muddy sediment and high-salinity waters on the landward side of the Outer Banks. However, plants that prefer brackish water have undergone some dramatic changes and shifts.

Though there is little scientific information about the past abundance of submerged plants, old timers and fishermen's journals from the late 1800s describe extensive beds of grasses in many bays along the mainland where there are none today. Such anecdotal evidence suggests that as much as half of the beds along the mainland side of the state's sounds are gone.

In the upper half of the Pamlico River, for instance, grass beds were common until the mid-1970s. Fifteen years later, those beds have decreased 99 percent. Wild celery (Vallisnaria americana) was historically abundant in western Pamlico Sound and, to a lesser extent, in the Neuse River, with pondweeds (Potamogeton spp.) and widgeon grass also common. The plants in those areas declined significantly during the mid-1980s and then rebounded modestly.

THE THREATS

The reasons for the historic decline are many. Natural events, such as regional shifts in salinity because of drought or excessive rainfall, animal foraging, storms, or disease all play a role.

Other factors may be more significant, however. Dredging channels for navigation or marinas can destroy sea grasses by removing them or covering them with sediment. Docks built over seagrass beds can shade them out. Boat propellers can shear off plants or dig them up by their roots, as can some types of fishing gear, such as oyster or clam dredges.

Those kinds of physical damage tend to occur in specific areas and at certain times of the year. Degraded water quality, however, can affect grass beds over larger areas and longer periods of time. Like any plant, the grasses need light to grow. Too much sediment in the water can block sunlight from reaching the plants. Water enriched with too many nutrients can trigger algal blooms, which have the same effect. The sediments and nutrients come from many sources: wastewater treatment plants, eroding stream banks, rural and urban stormwater.

Runoff can also increase the amount of freshwater entering the estuaries, which can decrease salinity and affect the plants.

Ocean Hard Bottom: Structure, Structure, Structure

Recreational fishermen along the central North Carolina coast know that AR-342 is a good place to drop anchor. There, less than 3 miles from Bogue Inlet over concrete pipes and railroad boxcars, they can hook up with black sea bass, gray trout or a dozen other kinds of fish.

The 47 artificial reefs that dot North Carolina's ocean and sounds are among the best fishing holes on the coast. To fisheries scientists, these reefs, along with natural underwater rock outcrops, sunken wreck and jetties, are "hard bottoms." They're what the fishing magazines call "structure," and to a fisherman structure can mean the difference between catching fish or just getting a sunburn.

THE BENEFITS

Algae, sponges and invertebrates colonize the naturally occurring rocks, tires and boxcars used to build reefs. The result is a complex habitat that in North Carolina waters attracts at least 35 important species of fish.

Some, like black sea bass, sheepshead, pigfish and spadefish, need nearshore structures to spawn. The larvae of other species, like grouper and snapper, migrate to the rocks. Dozens of species, including bluefish, croaker, king mackerel, snappers, groupers, grunts, summer flounder and tautog go to the rocks, reefs and wrecks to find food or shelter.

Along with providing habitat for an abundance of marine creatures, the hard bottom rocks, through constant wearing by ocean currents, are sources of sand for sediment-starved sections of the continental shelf, such as Onslow and Long bays.

THE TRENDS

More than 92 percent of the identified natural hard bottoms in North Carolina waters are south of Cape Lookout, particularly in the southern half of Onslow Bay and in northern Long Bay. Concentrations of hard bottom occur seaward of inlets including Shallotte, Lockwood's Folly, New, Carolina Beach, Masonboro, New Topsail, New River and Bogue. There are outcrops of moderate to high relief in shallow water near the shoals of Cape Fear and Cape Lookout. Geologists estimate that the majority of the bottom in state territorial waters from mid-Onslow Beach to south of New Inlet and the area from Yaupon Beach west to Tubbs Inlet is hard bottom covered with a thin layer of sand.

THE THREATS

Dredging is the major threat. Dredges working near or on rock hard bottoms can have obvious direct effects, such as taking chunks out of the coral or rock. The indirect effects, though, can be just as damaging. Dredges stir up sediment along the bottom that can cover coral or other organisms that colonized the rock. Elevated turbidity for long periods can stress or kill those organisms.

Sand pumped on a beach during a re-nourishment project can also threaten rock bottoms if it later washes back into the ocean and increases turbidity or covers the rocks. Commercial and sport fishermen in the Wrightsville Beach area, where beach re-nourishment has been conducted regularly since the 1960s, reported that nearshore hard bottoms and mud sloughs that were productive fishing grounds are now covered in sand. They no longer fish there.

Some fishing gear, such as bottom longlines and trawls and fish traps, can do extensive damage. Fishing gear dragged across the bottom can uproot the rock from the seafloor, especially where the bottom is uneven and there is a concentration of coral and other permanently attached invertebrates. Dragged gear also indirectly damages hard bottom by smothering invertebrates with sediment.

The discharges from sewage and industrial plants can pollute hard bottom close to shore. Stormwater runoff can increase pollution levels in coastal ocean waters. Residues of DDT and PCB have been found in grouper and red snapper, indicating that toxins from stormwater runoff are potential threats to fish that use hard bottoms.

Black Sea Bass
Centropristis striata

Description: Basic color dark brown or black; dorsal fin has rows and stripes of white on black; large males have irridescent blue and ebony markings, and fatty hump in front of dorsal fin; females may have indistinct vertical bars; topmost ray of tail fin much elongated in adults; tail may be tri-lobed; sharp spine near the rear margin of gill cover.

Where found: A temperate, structure-loving fish, associated with reefs, rocks and rubble offshore. Smaller fish live closer to shore.

Size, Age: Reported to live as long as 20 years and reach a maximum size of 2 feet.

State Record: 8 lbs., 12 oz. Caught off Oregon Inlet in 1979.

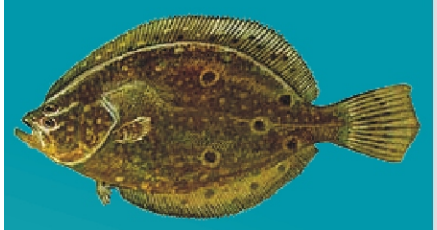
Life Cycle: Spawning begins in March off North Carolina and occurs progressively later (until October) farther north. A female produces about 280,000 eggs, which are buoyant and contain a single oil globule. Larvae develop two to 50 miles offshore at depths of up to 108 feet. When they are about a half-inch long, young bass move into estuaries, bays and sounds, where they find shelter in beds of submerged aquatic vegetation, oyster reefs, and among wharves, pilings and other structures. Young black sea bass feed primarily on crustaceans, such as shrimp, amphipods and isopods. Adults rely on their large mouths to capture their prey, which include other fish, crabs, mussels and razor clams.

Cool Fact: Black sea bass are "protogynous hermaphrodites," which means that initially they are females, but some fish change sex to become males between 9 and 13 inches in length.

Average Commercial Landings, 1992-2001: 458,934 lbs. (74 percent are caught south of Hatteras).

Average Recreational Landings 1992-2001: 163,741 lbs.

Stock status: Concern south of Cape Hatteras. Overfished north of Cape Hatteras.



Summer Flounder
Paralichthys dentatus

Description: Like all flounders, the summer flounder has both eyes on the same side of its head; in this case, the left side. The side with the eyes is brownish with conspicuous black spots; the eyeless side, which rests on the bottom, is almost white. However, the fish can change color to match its surroundings. It also may partially bury itself in the bottom for camouflage.

Where Found: In sounds and bays from the Gulf of Maine to Florida.

Size, Age: Females may live up to 20 years, but males rarely live for more than seven years. Females can reach 26 pounds.

State Record: 20 lbs, 8 oz.

Life Cycle: Summer flounder migrate inshore and north during late winter and early spring and offshore and south during the fall. Summer flounder spawn from November through March when water temperatures are between 53 and 67 degrees. Larval flounder enter inlets and settle on sandy bottoms in higher-salinity areas of estuaries. After their first year, they move into ocean waters to spawn and join coastal migratory groups. Like other flounders, this species is a bottom-dwelling predator with quick movements and sharp teeth. It can capture small fishes, squid, sea worms, shrimp and other crustaceans that make up the bulk of its diet.

Cool Fact: A popular flatfish from North Carolina to Massachusetts, summer flounder are called fluke in the Northeast.

Average Commercial Landings, 1992-2001: 3.1 million lbs.

Average Recreational Landings, 1992-2001: 381,729 lbs.

Stock Status: Recovering. The estimated percentage of age fish 4 and older has increased significantly since the early 1990s, and the estimated spawning stock biomass in 1999 was the highest in 18 years.

Soft Bottoms: Shifting Sands Used by Many Species

The shifting sands of an inlet or the muddy bottoms of coastal rivers offer important sanctuary or food to numerous fish and other aquatic animals.

These "soft bottoms" include everything from the sandy and shelly ocean floor just off the beach and the sand flats at inlets that appear and disappear with each day's tide to the muddy muck of a sound or tidal creek or a coastal freshwater river or stream.

Change is what binds them. Wind, water and waves constantly work the bottom, moving sand or mud or burying it under other layers of sediment. Some of these places are even exposed twice a day by the tide. The result is a system in motion, where temperature and salinity can vary widely and where nutrients and other food can collect.

THE BENEFITS

Scores of different fish and shellfish use these habitats at various times in their lives. Largemouth bass, yellow perch and bluegill are among the freshwater fish that spend their entire lives in our coastal freshwater rivers, but they are joined in the spring by American shad, striped bass and other types of anadromous fish that live in saltwater but spawn in our coastal rivers. The young of many other bottom-dwelling coastal fish, such as southern flounder and croaker, migrate to the lower reaches of these same rivers.

Young brown shrimp and blue crabs use the lower-salinity waters of the sounds as a nursery, while young spotted seatrout and weakfish use waters with higher salinity. Baby pink shrimp, black sea bass and red drum seek the bottom in the sounds with the highest salinities. Adult summer flounder lurk partially covered on the bottom, blending in with their surroundings and ready to pounce on their unwary prey.

Clams are abundant on the sound's sandy flats where they can filter food from the water without competition from the worms that crowd the mud bottoms. The worms stir up mud as they feed, which can clog the clam's delicate gills. The flats' shallow water also provides refuge from large predators. Atlantic menhaden, bay anchovy, striped mullet, and summer and southern flounder are just some of the fish species that use the flats.

Red drum spawn in the inlets, and female blue crabs release their eggs there. The drum cruise the surf and sloughs looking for a meal and are joined at different times of the year by striped bass, weakfish, kingfish – also called Virginia mullet, sea mullet and whiting – and croaker. In the spring and summer, young Florida pompano arrive along our beaches to greedily feed on mole crabs that burrow in the sand at the water's edge.

Summer, southern and gulf flounder gather along the soft bottom nearshore to spawn in the winter and early spring. Striped mullet, several species of sharks, and stingrays also spawn there.

THE TRENDS

Soft bottom habitats abound. They are found in freshwater rivers like the Chowan, Neuse and Cape Fear; in sounds like Pamlico, Core and Bogue; in countless creeks and all the inlets; and along more than 320 miles of ocean shoreline.

THE THREATS

Compared with other types of critical habitats, soft bottoms are resilient but they are threatened by pollution and can be physically damaged by dredging, some types of fishing gear and shoreline development. For example, sedimentation and bank erosion are primarily responsible for damaging habitat in 37 percent of the freshwater streams in the coastal area. Sand flats can be damaged or destroyed by dredge material from navigation channels, sedimentation from construction sites, and oil pollution from marinas and boats.

Inlet jetties built perpendicular to shore can be barriers to migrating fish and larvae that move with the current along a narrow band close to shore. These larvae include many of North Carolina's most important commercial and recreational fish species, such as menhaden, spot, Atlantic croaker, shrimp and flounder.

Beach re-nourishment, stormwater runoff and recreational vehicles could affect soft bottoms along the ocean beach.

Shell Bottom: Water Filter and Baby Nurseries

Oysters are excellent ecosystem engineers. The homes that they build in the shallow waters of our estuaries help keep the water clean, protect the shoreline from damaging waves and attract a wide array of other marine creatures that come to the oysters' home to eat, reproduce or find shelter from predators.

The oysters usually make these reefs or beds, but sometimes we lend a hand by creating reefs from oyster or clamshells to give baby oysters a foundation on which to grow. Either way, these "shell bottoms" are among the most productive fish habitat in the sounds.

THE BENEFITS

Combine a cafeteria buffet with a hospital nursery and you come close to what this habitat means to the more than 40 species of fish and crustaceans that have been found on shell bottom. Some live there. Shrimp and small fish such as gobies, blennies and toadfish feed on the algae, bacteria, fungi and worms that colonize the oyster reefs.

Others need the reefs to successfully spawn. Toadfish, for instance, attach their eggs to the underside of oyster shells, while gobies, blennies and skilletfish place their eggs in recently dead oyster shell.

The small fish and crustaceans, of course, attract larger species in search of a meal. Red and black drum, bluefish, spot, Atlantic croaker, weakfish, spotted seatrout, summer and southern flounder, and blue crab are just a few of the important species that feed at shell bottoms.

Newly hatched sheepshead, gag, snappers, shrimp, and stone and blue crabs find shelter among the shells, which are considered important nursery habitat for numerous species.

The oysters themselves play a vital role as the estuary's natural filter. One adult oyster can filter about 50 gallons of water a day. By removing organic material and nutrients from the water, the oysters help keep the water clear and free from algae.

Shell bottom also stabilizes stream banks and decreases erosion. Large areas of oyster shells can block waves and reduce erosion and turbidity.

THE TRENDS

During colonial times, oyster reefs grew so extensively in North Carolina waters that they were considered a threat to navigation. Unwary mariners could easily sink their wooden boats if they ran aground on the reefs, some of which extended for hundreds of acres.

Since then, though, the state's oyster population has collapsed under the weight of disease and overfishing. The commercial harvest fell throughout the 20th century and is now at historic lows. With the oysters have gone the habitat.

The N.C. Division of Marine Fisheries has mapped about 223,000 acres, or about 42 percent, of the state's shallow salt and brackish estuarine bottoms and found about 12,500 acres of shell bottom. Most of the shell bottom is found along the state's southern coast.

THE THREATS

Fishing for oysters with towed dredges is the greatest threat to shell bottom. Studies have shown that using dredges for one season can reduce the height of an oyster reef by 30 percent. Trawling for shrimp, crabs and clams and dredging channels can do similar, but less dramatic, damage to the reefs.

Recognizing the dangers, the state has restricted mechanical dredging for oysters. Yet, the reefs haven't recovered. Water pollution may be one reason, and diseases may be another. Sediment washed off the land during storms can bury oyster shells. Without the shell on the bottom, oyster larvae can't attach themselves, or "set." Excessive sedimentation can also harm shellfish by clogging their gills. Sediment was the largest cause of water-quality degradation in the Albemarle-Pamlico estuary. The state's Division of Water Quality lists it as a problem for 964 miles of North Carolina waterways in 125 water bodies, including 25 in the Cape Fear River basin, 18 in the Neuse River basin, and 11 in the Tar-Pamlico River basin. All have shell bottom.

Excessive nutrients, such as phosphorus and nitrogen, can also lead to "dead water," the fishermen's term for water so low in oxygen that it can't support life. Oysters, which are unable to move to better water, can suffocate.

Eastern Oyster

Crassostrea virginica

Description: Thick, irregularly shaped shell with coarse, sharp edges. The upper shells are almost flat while the lower shell is deeper.

Where Found: In shallow water estuaries along the East and Gulf coasts, from the Gulf of St. Lawrence to Texas. Prefers low and moderate salinity water.

Size, Age: Can live up to 40 years and grow up to eight inches. In North Carolina, however, most are harvested in three years at a minimum size of three inches.

Life Cycle: Oysters spawn from May to September. Eggs hatch into larvae, which develop into several stages. In the early stages of an oyster's life, currents carry it about. As it matures, the oyster sinks to the bottom. To survive, the oyster must land on a hard surface. That is why they are found growing together in clumps or rocks.

Cool Fact: The oyster matures at age one, and can be male or female as needed for the sex ratio of the local population.

Average Commercial Landings, 1992-2001: 229,999 lbs of meat.

Average Recreational Landings, 1992-2001: Unknown.

Stock Status: Depressed. Increased fishing pressure and stock declines caused by diseases, poor water quality and habitat loss have led to the collapse of this once prosperous fishery.

Attend A Public Meeting

All meetings begin at 7 pm. For more information please call the CHPP office at 252-726-7021 or 800-682-2632.

Wednesday
July 23, 2003
NC Museum
of Natural Sciences
Raleigh

Thursday
July 24, 2003
Mooresville Citizens Center
Mooresville

Tuesday
July 29, 2003
Brunswick Electric
Membership Corporation
Supply

Wednesday
July 30, 2003
Northeast Branch of
New Hanover County Library
Wilmington

Tuesday
August 12, 2003
Dixon High School
Holly Ridge

Wednesday
August 13, 2003
East Carteret High School
Beaufort

Tuesday
August 19, 2003
N.C. Aquarium
Manteo

Wednesday
August 20, 2003
Town Council Chambers
Edenton

Tuesday
September 9, 2003
N.C. Estuarium
Washington

Wednesday
September 10, 2003
Pamlico County High School
Bayboro

To Learn How to Get Involved in the CHPP Process:

- Go to *www.ncfisheries.net*
- Send an email to *chpps@ncmail.net*
- Call **800-682-2632** or **252-726-7021**. Ask for the CHPP office.
- Mail us your contact information on page 4.
- Attend regional public meetings on the CHPP to share your experience and ideas.

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