Wetlands *and* Fish:  Catch *the* Link

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Wetlands and Fish: Catch the Link

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Fish Need Wetlands

Fish[1] and humans have similar basic survival needs. Both require food, shelter, and a healthy environment. Wetlands fulfill these essential needs for fish across the United States. For example, shrimp feed and grow in the tidal marshes of the Mississippi delta. Striped bass pursue killifish living in the salt marshes along the Chesapeake Bay. Young salmon rest in the brackish marshes along the Pacific Coast, until their bodies adapt to salty ocean waters. Alewife and blueback herring lay eggs in the forested wetlands along rivers in the eastern United States. Different types of wetlands provide fish with food, refuge, and safe areas to lay their eggs.

This publication explains the critical link between wetlands and the survival of fish populations. Reading this publication will give you information to help you educate others about the importance of wetlands to fish and ideas for how to conserve wetlands in your community. If you catch fish, eat fish, or appreciate the beauty of fish and their importance in the web of life, this publication will assist you in becoming involved in wetlands conservation. If you already understand the importance of wetlands, this information can be used to reach out to fishing communities to join you in your efforts to protect wetlands.

What is a Wetland?

Wetlands can be as small as a backyard pond or as large as the Everglades, and they are found throughout the United States and on every continent except Antartica. The primary characteristic that differentiates wetlands from other landscape features is that they are wet. Within this publication, wetlands are defined as vegetated areas that are covered with water or have very wet soils for part of the year. However, there are many different legal and scientific definitions of wetlands that include other characteristics. Other wetland definitions include wet areas without vegetation, but this document focuses on vegetated areas because wetland plants provide a unique habitat and other benefits to fish that unvegetated areas do not provide.

What kinds of wetlands exist in your community? If you live near a river, there are probably wetlands along the river and in the floodplain. If you live near a lake, there may be wetlands in shallow areas around the edge of the lake. If you live near the ocean, wetlands may be located behind the beach dunes or in shallow bays. Even if there is no open water near your home, a wet shrubby depression or grassy valley could contain wetlands that fill with water during the rainy season and are dry for the rest of the year. Wherever you live, it is more than likely that wetlands are nearby.

It is important to remember that wetlands do not exist in isolation, but are instead a part of an extensive, interconnected system of land and water called a watershed. A watershed is the area of land that drains to a particular body of water such as a river, lake, or wetland. Wetlands are linked to the atmosphere through the hydrologic cycle. Rain enters wetlands directly or through lakes, streams, and groundwater. Wetlands help regulate the hydrologic cycle by holding rainwater and slowly releasing it back into streams and lakes, ensuring that fish have a constant and steady water supply.

Wetlands are vital to fish populations because fish depend on certain wetland processes. Wetlands serve as a food base, shelter, spawning and nursery areas, and for water filtration. They contain large volumes of food that attract many animal species. Plants and other organic matter provide food for small aquatic insects, fish, and shellfish. In turn, the smaller insects and fish become food for larger predatory fish, reptiles, amphibians, birds, and mammals. Wetlands not only provide food for aquatic and non-aquatic animal and fish species, they also provide vegetated areas where fish can reproduce, hide from predators, and take refuge from inclement weather or other changes in the physical environment. Wetlands also filter out sediments and pollutants, providing the clean water that fish need. Thus, a network of abundant and healthy wetlands is vital to the survival of most fish species.

Declining Wetlands, Declining Fish Habitat

Despite the important benefits that wetlands provide, more than 50 percent of the wetlands in the lower 48 states have been affected by pollution or development since colonial times. Fortunately, wetlands now are recognized as a necessary and integral part of natural

[1] The term “fish” refers to both finfish and shellfish, unless otherwise specified

ecosystems. Federal, state, and local regulations have curbed losses of this important ecosystem during the last 20 years. Despite a better understanding of their importance and regulations restricting wetlands destruction, the United States continues to experience a net loss (approximately 58,500 acres per year from 1986 to 1997) from development, agriculture, and transportation projects.

Increased development and continued conversion of wetlands to other uses result in wetlands being degraded or destroyed. As a result, it becomes more difficult for fish to find the habitats they need. Studies reveal that one factor limiting the survival of juvenile coho salmon is the lack of habitat such as forested wetlands, beaver ponds, and stream pools they need to survive through the rainy winters. Blue crab populations along the East Coast may be declining due to the loss of the eelgrass beds that juveniles and molting adults need to hide from predators. Declining fish habitat may result in the listing of fish under the Endangered Species Act.

Wetland loss and declining fish populations affect not only natural ecosystem functions, but commercial and recreational fishing as well. In total, the marine and freshwater commercial and recreational fishing industries contribute hundreds of billions of dollars to the U.S. economy and provide jobs for millions of American citizens each year. The U.S. Department of Commerce reports that during 1999 Americans spent approximately $52.3 billion on seafood products, including money spent at restaurants and grocery stores. According to the U.S. Fish and Wildlife Service, America's 35 million adult anglers spent approximately $37 billion on fishing activities in 1996. With sportfishing supporting 1.2 million jobs nationwide, the American Sportfishing Association reports that if sportfishing were ranked as a corporation, it would place 13th on the Fortune 500 list of America's largest businesses.

Wetland destruction and its effect on fish populations are among the many issues forcing us to re-evaluate our activities on the land. The linkage between the land, water, and atmosphere assures that there is no lake, stream, ocean, or wetland that has not been affected by human activity. Pollution, habitat destruction, and the introduction and subsequent population explosions of non-native species have brought us to a point where more than one-third of the freshwater fish species found in North America are listed as endangered, threatened, or of special concern by at least one state. Conserving and restoring wetlands are good places to start to reverse this trend.

Fish swimming among mangrove roots.

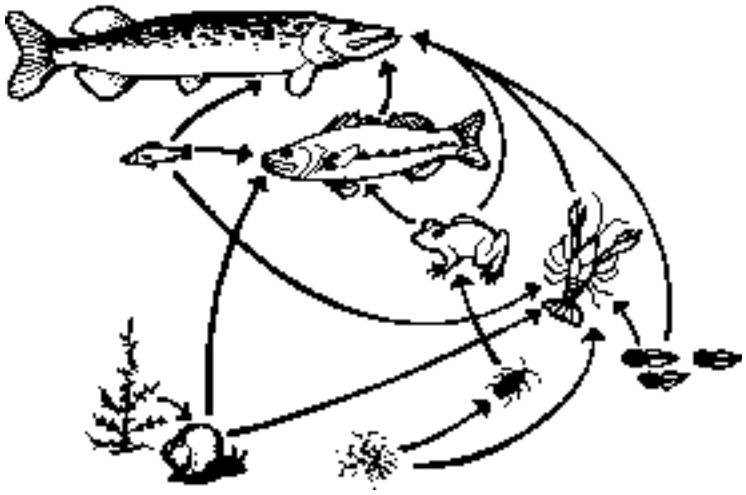
Sari Kiraly

Wetland Functions Are Essential to Fish

Food, shelter, clean water, and a safe place to raise young are as vital to fish as they are to humans. Wetlands can fulfill many fish needs because of their functions, such as providing habitat, producing food, and cycling nutrients. The most important wetland functions for fish survival are food production, spawning and nursery habitat, refuge, and the reduction of harmful pollutants in water.

Function: Food Production

Wetlands provide a plentiful food supply because of their rapid plant production. Some fish eat plant parts while other fish eat small insects and crustaceans that eat or live on plants. Some fish prefer wetland plant material that has been decomposed by bacteria, worms, and aquatic insects into an energy-rich organic material called detritus. In addition to being enriched with nutrients important for fish growth, detritus flows throughout the aquatic system. For example, the alternate flooding and drying of forested floodplains increases plant growth, detritus production, and nutrient availability. These products are then washed downstream, benefiting fish living many miles away, such as the menhaden, whose diet is one-third detritus. Furthermore, fish do not have to eat detritus directly to benefit from this large source of wetland food production. For example, striped bass eat smaller fish and shellfish that consume detritus.



A Food Web Wildlife Forever

Humans also rely on wetlands for food. Although most of us would not find a plate of steamed cattails appealing, many people would enjoy some mouth-watering, grilled largemouth bass. Largemouth bass also don't like to eat wetland plants or detritus directly, but they do eat red swamp crawfish. And red swamp crawfish eat detritus. The relationship between wetland plants that produce detritus, red swamp crawfish that eat detritus, largemouth bass that eat red swamp crawfish, and people who eat largemouth bass is an example of a food chain. Through a series of interconnected food chains, known as food webs, wetland plants support fish and all of the birds, reptiles, bears, otters, sea lions, and people who eat fish.

Food webs have a delicate balance. For example, wetland degradation affects not only golden shiners that live and eat in swamps, but also herons, egrets, kingfishers, and water snakes that eat golden shiners. In addition, breeding success of the California brown pelican is strongly correlated with abundance of anchovies that feed in salt marshes and other wetlands. In fact, population declines of many marine mammals and seabirds have been linked to diminishing populations of the fish they eat. Because of the interconnected nature of food webs, any wetland alteration that disrupts the food web can have a cascading effect on fish, wildlife, and human populations.

Function: Spawning and Nursery Areas

Fish eggs and young fish have different needs than adult fish, which is why many adult fish live in other habitats and then lay eggs in wetlands. Defenseless and immobile eggs can be hidden from predators among wetland edges and underwater grasses. Wetland plants, dead plant material, and detritus provide a surface for fish to attach their eggs. When the eggs hatch, the vegetation becomes both a protective cover and a food source. Young fish dart into the wetland vegetation to hide, while the juvenile stages of bay scallops, hard

clams, and some other shellfish cling to salt marsh vegetation and seagrasses for several weeks before settling on the bottom. Most shrimp harvested in the Gulf of Mexico depend on salt marshes for nurseries. The vegetation protects young shellfish until they have grown large enough to ensure their survival on the estuary floor. Shallow waters in wetland ecosystems provide shelter for young fish from adult predators because many adult fish cannot live in shallow water.

Wetlands provide productive spawning areas for fish. Northern pike swim from the deep waters of Lake Erie to spawn in freshwater marshes along the shoreline. The adults leave the marshes soon after spawning, but larvae and juveniles remain in the protective vegetation until mid-summer, when the shallow waters become too warm. Anadromous fish, such as salmon and river herring (alewife and blueback), migrate hundreds or thousands of miles from saltwater to freshwater streams and streamside wetlands to spawn. Blueback herring spawn when floodwaters allow access to the abundant food supplies of streamside hardwood forests. Although many salmon species lay their eggs in the moderate-moving water of streambeds, the larvae and juveniles exploit the abundant food supply of streamside wetlands during floods. Some populations of chum salmon spawn directly in coastal marshes. Striped bass migrate to freshwater areas to spawn so juveniles can use tidal freshwater wetlands as nursery and feeding areas.

Function: Refuge

Adult and juvenile fish alike use wetlands to hide from predators. Thick plant growth can visually confuse predators and camouflage small fish. Juvenile muskellunge, northern pike and other small fish with green and mottled coloring can blend in with marsh grasses, virtually disappearing before a would-be predator's eyes. Dense vegetation and shallow water prevent many predators from entering coastal marshes and other wetlands. Gobies, anchovies, juvenile snook, and juvenile spotted seatrout dart into the intertwining root systems of mangrove wetlands to escape larger predators. The root systems of trees and shrubs in floodplain wetlands allow stream banks to hang over the water, providing protective habitat for chinook salmon, cutthroat trout, and other fish.

In addition to using wetlands to elude predators, fish need wetlands to escape changes in environmental conditions such as changes in water level, velocity, or bad weather. Coho salmon rely on the calmer waters of forested wetlands adjacent to streams to escape the fast currents of Pacific Northwest streams during winter floods.

Function: Clean Water

Clean water is as important to fish as clean air is to people. Wetlands help to clean water by filtering out potentially harmful pollutants. Some pollutants can become trapped by wetland vegetation and then stored within layers of sediment. Other pollutants are transformed into less harmful forms by wetland plants and small organisms called microbes.

Wetlands provide natural filtration in a way that is much less expensive and far more efficient than technology. In 1991, scientists estimated that if it was possible to mimic the filtering capacity of the bottomland hardwood wetlands found throughout South Carolina, it would cost millions of dollars to construct such a water treatment plant. Not only would a treatment plant be difficult and costly to construct, the plant's maintenance would cost even more.

Wetlands also reduce the effects of natural water quality changes on fish populations. The roots, stems, and leaves of wetland plants slow down water flows, reducing streambank and shoreline erosion. Minimizing erosion reduces the amount of sediment in the water that can clog fish gills or smother fish eggs. For example, Lake Erie marshes trap silt, benefitting species that need clear water and sand or gravel bottoms to spawn. Forested wetlands in the North Carolina coastal plain regulate the flow of freshwater into brackish and estuarine nursery areas downstream. Without this valuable function, salinity levels would change drastically with each rainfall, placing stress on fish and other aquatic organisms that rely on a delicate balance of freshwater and saltwater.

Which Fish Use My Wetland?

The first step in learning about the fish that live in local wetlands is to determine what type of wetland is in your backyard or neighborhood. Compare your wetland to the descriptions of common wetland types on the following pages. Then, turn to the page for that wetland type and see what fish species might be found there. Please note that many more species of fish use wetlands than have been listed in this publication. Also, many species use more than one type of wetland but were used as an example for only one wetland type in this publication. For more information on the variety of fish that can be found in wetlands, please see Appendix A. These tables list many of the fish species known to use each common wetland type, how each species uses the wetland, and the regions of the country where each fish is found. Additional information can be found at the National Marine Fisheries Service's Office of Habitat Conservation web page, www.nmfs.noaa.gov/habitat. Finally, go straight to the source - your wetland - to find out exactly which fish are using it.

Wetlands come in many shapes, sizes, and forms. The unifying feature of these ecosystems is that they are wet. Different fish species reside in different types of wetlands. The amount of water in a wetland and the length of time the wetland stays wet influences the fish species that can benefit from the wetland. The type of wetland, its geographic location, salinity level, and vegetation type are important features that determine the fish species found in a particular a wetland.

What makes a wetland a usable habitat for fish? Fish need standing water that is deep enough not to freeze solid in the winter. Marshes along rivers, lakes, and estuaries often are flooded and are easily accessible to many types of fish. However, wetlands do not have to be wet all the time to be important habitat for fish. For example, forested floodplains that may have standing water for only a few weeks at a time are vital to the reproductive cycles of many fish such as American eel and Pacific salmon that live part or all of their lives in streams and rivers. Not every wetland is accessible to fish. Some wetlands are shallow depressions in the landscape that collect rain and runoff for only a few months every year. To be good fish habitat, wetlands that dry up in the summer must be close enough to another water source to allow fish to migrate back to safer, more permanent waters when necessary.

Wetlands can be grouped numerous ways based on similar and differing characteristics. Sorting wetlands can sometimes be useful to determine what fish might be found in them. Several methods have been developed to describe different wetland types. This publication separates wetlands into categories based on whether or not they are tidal, whether the water is salty or fresh, and the type of vegetation that most commonly grows in the wetland.

Common Wetland Types

Saltwater Wetlands

For all saltwater wetlands, the salinity varies with season, time, precipitation, location, and water depth.

Seagrass Beds

Submerged saltwater wetlands in all coastal states except Georgia and South Carolina. Vegetation includes rooted submerged plants (eelgrass, turtlegrass, widgeon grass, etc.) collectively known as seagrass. Although the plants look similar to grasses, they are not part of the grass family.

Tidal Salt Marshes

Tidal (water depth varies with the tide) saltwater wetlands usually vegetated by salt-tolerant grasses, rushes, sedges and other soft-stemmed plants. Found along protected coastlines throughout the United States.

Mangrove Wetlands

Tidal wetlands in the Southeast, Gulf Coast region, and Hawaii, dominated by short salt-tolerant mangrove trees. Like salt marshes, mangrove wetlands require protection from the open ocean. Mangrove trees are noted for their unique system of twisted roots that rise above the water surface and provide fish and wildlife habitat.

Freshwater Wetlands

Freshwater wetlands receive water from one or more sources: precipitation, surface water or ground water.

Tidal Freshwater Marshes

Tidal (water depth varies with the tides) freshwater wetlands dominated by grasses, sedges, rushes, and broad-leaved aquatic plants. Found throughout coastal regions.

Non-tidal Freshwater Marshes

Freshwater wetlands that are not tidal, but water depth may vary with the seasons. Can be wet all year or dry up seasonally. Vegetated by a wide variety of soft-stemmed aquatic plants such as cattails, arrowheads, pickerelweed, reeds, grasses, and sedges. Can be isolated from other water sources or may border a river, lake, or pond. Found throughout the country, this type includes prairie potholes, playas, some vernal pools, and fens.

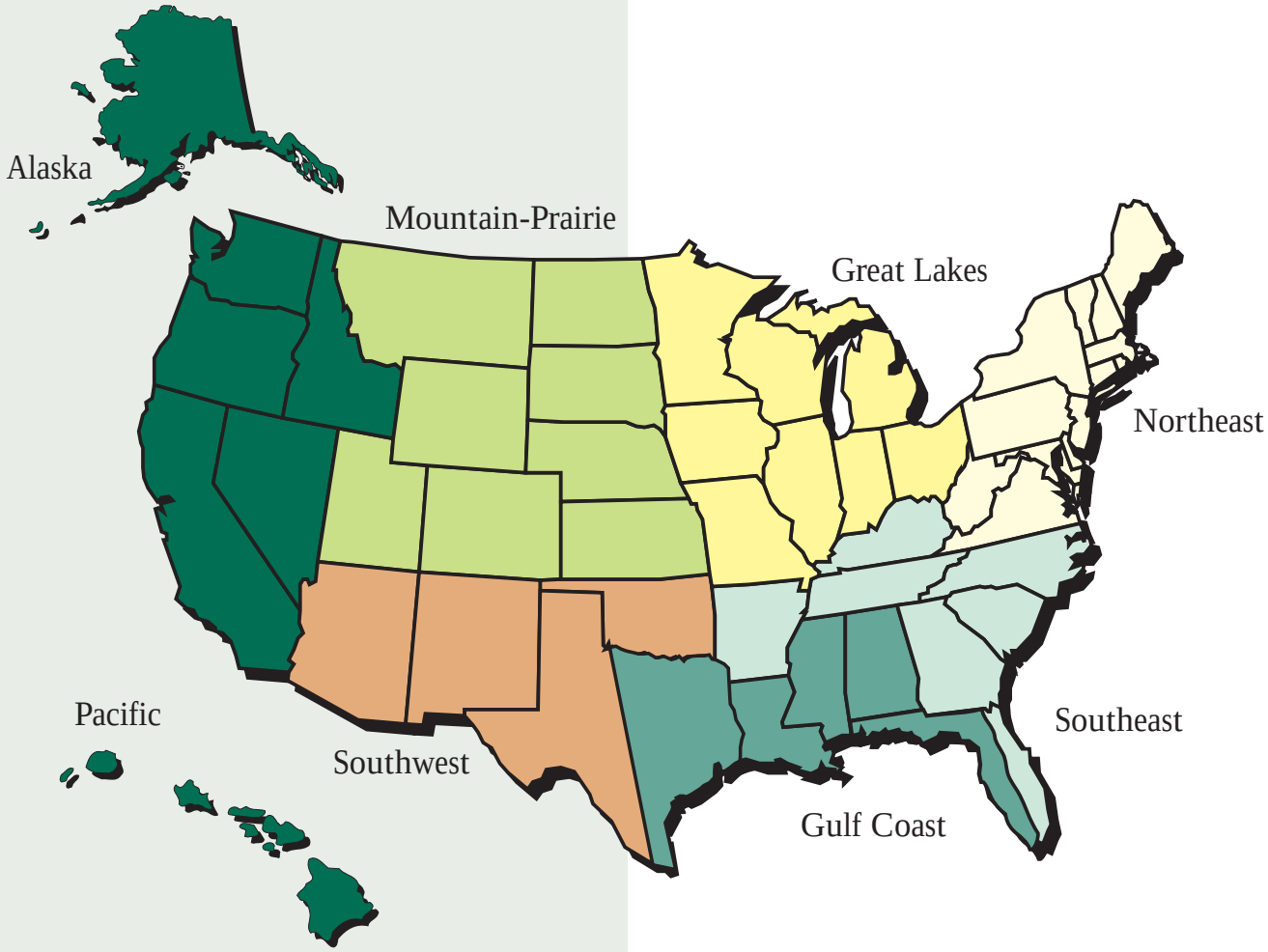
Forested Wetlands

Freshwater wetlands that can be tidal or non-tidal, but water depth may vary with the seasons. Vegetated by trees such as red maple, cypress, tupelo, and/or evergreen shrubs. Found throughout the country, forested wetlands include floodplains of rivers, back-water swamps, pocosins, and bogs. These wetlands can appear seasonally dry.

Regions of the United States

Because wetlands and fish populations vary from place to place, this document divides the United States into several regions. These region names are used in the rest of this section and in Appendix A.

- **Pacific**
- **Southwest**
- **Great Lakes**
- **Southeast**
- **Northeast**
- **Mountain-Prairie**
- **Alaska**
- **Gulf Coast**



Seagrass Beds

If you live in any coastal state, except Georgia and South Carolina, seagrass beds brimming with fish may be nearby. Seagrasses are grass-like plants that live in shallow, salty waters of the world's coastal zone, where they constantly are battered by waves and tides. Beds can be small, isolated patches that shift over time or vast carpets covering many hundreds of miles of ocean floor. Seagrasses must have clear, salty water to live.

Alaska seagrass bed U.S. Fish & Wildlife Service

The coasts of Georgia and South Carolina have water that is too fresh and too turbid for seagrass beds to survive. Fish almost always have access to seagrass beds, because they usually remain submerged, even at low tide. The grasses slow water currents, making movement easier for fish. They also reduce turbulence and erosion by stabilizing the sea bottom with their roots and by trapping fine sediments and suspended particles. This function helps provide the clear water many fish and eggs need to breathe.

Fish prefer a variety of foods, and seagrass beds are excellent places to find diverse food sources. Pinfish, queen conch, and other fish eat the grass blades directly. For those fish that find the grass unappetizing, there are many other choices on the seagrass bed menu, including detritus from decomposing leaves, organisms that attach themselves to the grass blades, and the smaller fish, shellfish, and invertebrates that live among the seagrass beds. Some coral reef inhabitants, such as parrotfish and snappers, often forage in seagrass beds at night. Juvenile and adult fish move into seagrass beds to feed or hide from predators during high tide and move back into deeper water as the tide falls. Bluefish, weakfish, and spotted seatrout are among the large predators that will eat smaller fish in the seagrass beds at high tide.

Juvenile fish may use other types of habitat along the coasts, but the thick tangle of seagrass blades seems to be their preferred place to live, eat, and hide from predators. Schools of juvenile fish are found in seagrass beds during spring and summer, when the beds are growing in full force. Seagrasses provide a spawning surface for a variety of fish, including Pacific herring and bay scallops. Young bay scallops attach to seagrass blades to reduce their risk of being eaten by small crabs that patrol the sea bottom. In fact, the population of bay scallops in the Chesapeake Bay collapsed during the 1930s when a disease apparently killed most of the seagrass beds.

Fish Found in Seagrass Beds

Atlantic stingray (Dasyatis sabina)
This small ray lives in shallow coastal waters from Florida and the Gulf of Mexico north to the Chesapeake Bay and eats small crustaceans and invertebrates found in seagrass beds.

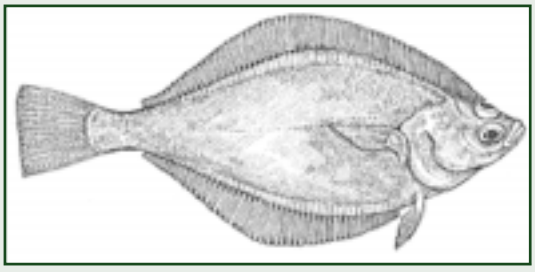
Bay scallop (Argopecten irradians)
This important commercial scallop attaches to seagrass blades as juveniles before settling on the bottom. Bay scallops live along the Atlantic, Pacific, and Gulf Coasts, using wetlands for food, refuge, spawning, and as a nursery.

Bay scallop

NOAA

English sole (Parophrys vetulus)
This fish uses shallow coastal water, including seagrass beds, for food, shelter, and as a nursery. They eat crustaceans, worms, and other small aquatic animals often found within seagrass beds. Marketed as filet of sole, they are commercially important on the West Coast, including Alaska.

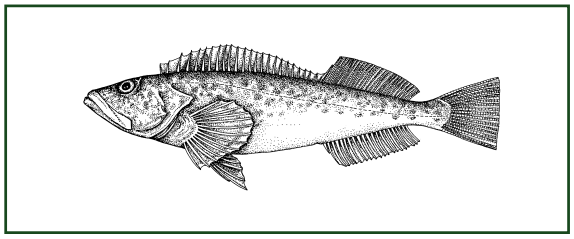
English sole



NOAA

Lingcod (Ophiodon elongatus)
Juvenile lingcod prefer to feed and seek shelter in shallow, inter-tidal areas of bays near seagrass beds. An important commercial and sport fish along the Pacific Coast, it uses wetlands for food and refuge.

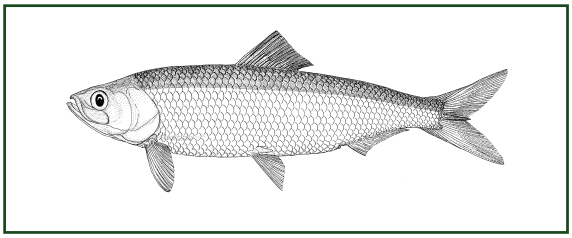
Lingcod



National Ocean Service

Pacific herring (Clupea pallasi)
This herring species spawns in shallow Pacific shoreline wetlands. The fertilized eggs attach to seagrasses, algae, and marsh grasses. This species is commercially important, particularly for its eggs. Other commercial uses of this fish include table food (fresh or salted), fish meal, and bait.

Pacific herring



National Ocean Service

Spotted seatrout (Cynoscion nebulosus)
This popular commercial and sport fish prefers shallow, grassy areas including seagrass beds and salt marshes in the Northeast, Southeast, and Gulf Coast regions. Spotted seatrout eat grass shrimp and small fish. They use wetlands for food, refuge, spawning, and as a nursery.

Spotted seatrout

Diane Peebles

Striped mullet *(Mugil cephalus)*

This important commercial fish lives over shallow, muddy bottoms in the Atlantic, Pacific, and Gulf regions. It feeds by scooping mouthfuls of mud and digesting tiny plants as the mud passes through the gut. It uses wetlands for food, refuge, and as a nursery.

Striped mullet

Diane Peebles

For more comprehensive list of fish using seagrass beds see Appendix A.

Case Study: Seagrass Bed

Blue crab *(Callinectes sapidus)*

Life history: Blue crabs can be found along the Atlantic and Gulf Coasts. Their life cycle involves free swimming and bottom-dwelling stages that require a variety of habitats from marshes to open-water estuary. Females carry the eggs until they hatch into a floating stage. Eventually, the larvae move to the bottom and become small crabs. Crabs shed their shells and generate new ones to give their bodies room to grow. Soft-shelled crabs eat their old shells and use the calcium to grow new shells. Herons, gulls, fish, and people love to eat these soft-shell crabs.

Blue crab

NOAA

Importance of wetlands to blue crabs: Young crabs depend on seagrass beds and coastal marshes for food and refuge. Without these wetlands, the crabs have a limited viable nursery or protection from predators. Molting adults also rely on the protective cover of wetland plants. Adult blue crabs frequent grassy shallow bays to scavenge for smaller crabs, clams, seaweed, and dead fish.

Importance of blue crabs to people: Blue crabs support a large seafood industry in Chesapeake Bay and along the southeastern and Gulf Coasts. Crabs are boiled, roasted, curried, served cold, and spiced in homes and restuarants throughout these regions. In the Chesapeake Bay region, the blue crab represents a way of life. This symbol of the Chesapeake's proud heritage appears on coffee cups, keychains, and other souvenirs. Crab festivals, complete with hardshell races and the crowning of Miss and Little Miss Crustacean, are integral to the identities of Chesapeake Bay communities.

Status: Blue crab populations have declined in recent years at an alarming rate. In 1992, the harvest dropped from 91 million pounds to 54 million pounds. Loss of seagrass beds and over-fishing are considered major causes of the recent decline in blue crab populations.

Tidal Salt Marshes

Tidal salt marshes are common in coastal areas. Salinity in salt marshes varies depending upon the wetland's proximity to the ocean, and if there are freshwater inputs such as streams and precipitation. Salt marshes are thick with salt-tolerant grasses, rushes, and sedges, and their distribution varies depending on the salinity. Fish use the vegetation for food, refuge, and spawning areas. Salt marshes are available to fish daily because they generally are flooded at least once a day with the rising tide. Channels of deeper water cut through dense salt marsh vegetation like a maze and provide ready access to food.

Even at low tide, when most of the marsh plants are exposed to the air, fish are able to use salt marshes by swimming in the channels. Some smaller fish, such as killifish, live in salt marshes throughout their life cycle because they are able to survive in a wide range of conditions, including changes in salinity and temperature. One type of killifish, the mummichog, can

Tidal Salt Marsh

U.S. Fish and Wildlife Service

burrow into the mud when the tide goes out and wait for the water level to rise again. When the tide returns, mummichogs venture far into the shallow waters of the marshes in search of plentiful food supplies. Killifish are an important food source for predators such as striped bass, bluefish, and other larger fish.

The shallow water and harsh conditions of salt marshes prevent many larger fish from inhabiting salt marshes permanently. Instead, fish such as croakers, flounders, and halfbeaks move into salt marshes during high tide to feed on the abundant smaller fish and invertebrates, then return to deeper water when the tide goes down. Other fish are seasonal visitors and use the marsh for spawning, nursery grounds, or refuge from predators. Sticklebacks (fish that are related to seahorses and have bony plates along their sides) are seasonal spawners that build their nests in the marsh vegetation.

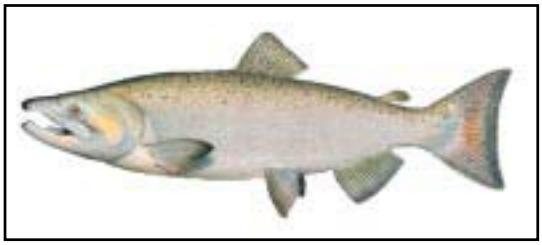
Many juvenile fish, including crabs, shrimp, striped bass, and alewife, benefit from the marsh. Along the Gulf Coast, juvenile drum, anchovy, mullet, and mojarra spend the summer months in marshes taking advantage of the abundant food and warm temperatures, increasing their growth rate.

Fish Found In Tidal Salt Marshes

Atlantic menhaden ***(Brevoortia tyrannus)***
This commercially important, though not well known, fish uses salt marshes along the Atlantic and Gulf Coasts as a nursery for young. This fish is used to produce fish meal and oil.

Chinook salmon ***(Oncorhynchus tshawytscha)***
Juveniles of this species live in salt marshes for six months or longer to benefit from abundant food sources and to adjust from the freshwater where they were hatched to the saltwater where they live as adults.

Chinook salmon



U.S. Bureau of Fisheries, 1906

Diamond killifish ***(Adinia xenica)***
This fish can be found from the central Atlantic Coast south to Florida and along the Gulf Coast. This important prey species lives in salt marshes and mangroves.

Dungeness crab (Cancer magister)

This crab uses salt marshes and seagrass beds along the northern Pacific Coast and Alaska as a nursery. Larvae hitchhike on jellyfish or ride tidal currents to get to the wetlands from their spawning grounds in the lower portions of estuaries. The young crabs seek food and refuge among the wetland vegetation until the crabs grow into adulthood. Adult crabs are a favorite food of seals, sea lions, and humans.

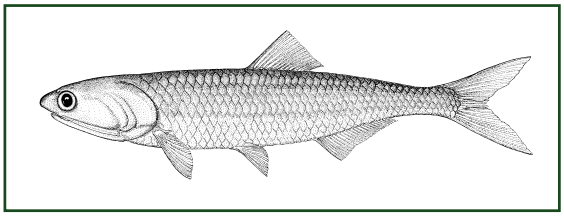
Dungeness crab

NOAA

Northern anchovy (Engaulis mordax)

This fish finds food and refuge from predators within salt marshes along the northern Pacific Coast. Northern anchovies eat small crustaceans and fish larvae found in wetlands, and in turn are eaten by larger fish and birds. In addition, the anchovy supports a multi-million dollar commercial fishing industry.

Northern anchovy



National Ocean Service

Saltmarsh topminnow (Fundulus jenkinsi)

This Gulf Coast species is dependent on salt marshes. Loss of valuable salt marsh habitat may lead to a future listing of the saltmarsh topminnow as an endangered species.

Striped bass (Morone saxatalis)

This popular commercial and sport fish lives in coastal waters, bays, and salt marshes along the Atlantic Coast, and has been introduced in the western United States and inland reservoirs. Juveniles eat small shrimp and other crustaceans, worms, and insects found in salt marshes. Adults feed on a wide variety of fish and crustaceans living in salt marshes and other coastal habitats. Adults spawn in salt marshes and freshwater tidal marshes.

Striped bass

Duane Raver

Summer flounder (Paralichthys dentatus)

Summer flounder is found along the Pacific, Atlantic, and Gulf Coasts and uses salt marshes as a nursery for young.

For a more comprehensive list of fish using tidal salt marshes, see Appendix A.

Case Study: Tidal Salt Marsh:

Coho salmon (Oncorhynchus kisutch)

Life history: Salmon are anadromous, meaning that they spend their adult lives in the ocean but migrate upstream to spawn. Young coho live in streams and backwater wetlands for up to a year, then migrate downstream to marshes in estuaries where they become adjusted to saltwater. Juveniles mature in the ocean about two years, before returning as adults to streams to spawn. Most salmon return to their natal stream, but a small percentage seeks out new locations. Salmon recognize their birthplace stream through their powerful sense of smell. Most Pacific salmon die after spawning.

Coho salmon

U.S. Bureau of Fisheries, 1906

Importance of wetlands to salmon: Flooded streamside wetlands offer food and protection to young salmon. During the rainy winter season, young coho seek refuge from strong currents in flooded wetlands, beaver ponds, and other areas of slow water. Tidal marshes and swamps provide a safe area with plentiful food resources for salmon to adjust to saltier water before entering the open ocean. Wetlands also are important for the survival of the smaller fish, crustaceans, and insects that comprise the salmon's diet.

Importance of salmon to people: Salmon belonging to the genus *Oncorhynchus,* including coho, chinook, sockeye, chum, pink, steelhead, and cutthroat trout, are often discussed together as "Pacific Coast salmon" when discussing economics and status. Pacific Coast salmon are extremely important commercial and sport fish. In 1997, approximately 570 million pounds of Pacific salmon valued at about $270 million were caught and exported canned or fresh. About 75 percent of the total U.S. catch of coho salmon comes from Alaska. However, the value of wild salmon cannot be -measured by dollars alone. Many Native American tribes celebrate the return of these majestic fish with elaborate rituals. Most Northwest states have designated members of the salmon family as their state fish. Salmon also are an important resource for subsistence fishing. A popular sport fish, coho salmon have been introduced to the Great Lakes region to provide sport for anglers.

Status: Heavy market consumption and the rapid destruction of and decreased access to habitat have led to the disappearance of Pacific salmon from 40 percent of their historical breeding ranges over the last century. Many remaining populations are reduced, and most runs are largely composed of fish produced in hatcheries. Many populations have been listed as threatened or endangered. Sport and commercial fishing for several species has been restricted or prohibited.

Mangrove Wetlands in the Everglades, Florida Kathryn Conant

Mangrove Wetlands

Mangrove wetlands are found along the coastline in Florida, Louisiana, Texas, and Hawaii. Mangroves are shrubby, salt-tolerant trees that grow along tropical and subtropical coasts. Among the states mentioned above, mangroves are most common in Florida. Mangroves, like salt marshes, require protection from the open ocean and can occur in a wide range of salinities.

How do fish live among trees? Mangrove trees have a thick root system that rises above the soil and water. When flooded by the tide, these roots provide excellent fish habitat. Juveniles and smaller fish hide among the mangroves, safe from larger fish that cannot navigate the tangled roots. Small fish and shellfish are known to swim in the streams and channels that meander through these wetlands. The stagnant backwater areas of mangrove swamps are permanent homes to killifish and other fish species that can tolerate low oxygen and high saline levels.

The extensive root system is not the only reason fish utilize mangrove wetlands. Detritus-rich soils of mangrove wetlands are a rich food source for both crabs and other invertebrates, which are in turn a food source for other fish. Young gamefish such as tarpon, ladyfish, snook, and gray snapper hide from predators among the mangrove roots to eat the abundant invertebrates.

Fish Found in Mangrove Wetlands

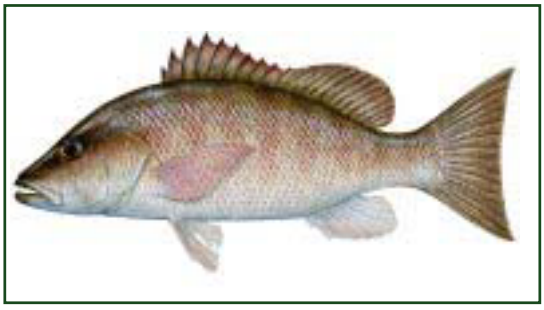
Dwarf seahorse (Hippocampus zosterae)

This fish lives in shallow water with grasses, floating vegetation, submerged roots of mangroves, or other vegetation.

Gray snapper (Lutjanus griseus)

This commercially and recreationally important fish spends its early life sheltered in mangrove swamps and seagrass beds. Adults also venture among the mangrove roots at high tide to exploit the wetland's rich food source.

Gray snapper



Diane Peebles

Ladyfish (Elops saurus)

This fish spawns in the open sea, but young ladyfish seek refuge and food in mangroves and other wetlands. This popular sportfish is noted for its habit of skipping along the surface of the water and for jumping after being hooked.

Ladyfish

Diane Peebles

Mangrove rivulus (Rivulus marmoratus)

This fish lives in shallow saltwater environments with vegetation, including salt marshes and mangroves. Some individuals seek protection in crab burrows. Mangrove rivulus can survive at low oxygen levels. Loss of salt marsh and mangrove habitats may lead to the future listing of this species as endangered.

Spotfin mojarra (Eucinostomus argenteus)

This fish seeks food and refuge along shallow, mangrove-lined tidal creeks. Spotfin has a mouth with jaws that can be extended to form a short tube used to suck up worms and other invertebrates from the bottom.

Tarpon (Megalops spp.)

These fish prefer warm, shallow waters including mangrove wetlands. They also use mangroves as a nursery for young. Tarpon can survive in areas with low oxygen levels. Adults feed at night on small fish and crustaceans.

Tarpon

National Ocean Service

For a more comprehensive list of fish using mangrove wetlands, see Appendix A.

Case Study: Mangrove

Shrimp *(Penaeus spp.)*

Life history: Brown *(Penaeus aztecus)*, white *(P. sertiferus)*, and pink *(P. duorarum)* shrimp are found along the Atlantic Coast from Massachusetts to Florida and within the Gulf of Mexico. Shrimp spawn in the ocean. After spending some time drifting in open water, larvae float with the tides into estuaries and salt marshes, where they settle to the bottom among the wetland vegetation. Adults eventually move back to the shallow water near the shore to spawn.

Importance of wetlands to shrimp: Shrimp need wetlands in order to survive. They benefit from tidal salt marshes as a food source and to escape predators, especially as juveniles. Juveniles eat marsh detritus and algae that grows on marsh plants. Studies have shown that as wetland acres increase and shrimp access to wetlands increase, shrimp production increases.

Shrimp

NOAA

Importance of shrimp to people: Brown, white, and pink shrimp are the most valuable commercial fishery in the United States. These shrimp also are important for recreational fishing. In 1999, 304 million pounds of shrimp, valued at $561 million, were caught in U.S. waters.

Status: U.S. shrimp harvests have been fairly steady since 1960, but there are concerns that continued wetland losses, particularly in the Gulf of Mexico region, could lead to sudden population declines of these wetland-dependent shellfish.

Tidal Freshwater Marshes

Tidal freshwater marshes are found farther upstream from the coast than salt marshes or mangroves. These marshes are close enough to the coast to experience tides, but at the same time are above the reach of the ocean's saltwater. Tidal freshwater marshes are found most often along the mid- and south-Atlantic coastline. Many of the plants found in tidal freshwater marshes, such as arrowhead, cattails, bulrushes, and other soft-stemmed plants, also can be found in non-tidal marshes, and therefore it is difficult to differentiate these wetland types solely by vegetation. Fish utilize the portions of the marsh that are closest to the river because these areas have deeper water and are flooded more regularly.

Kenilworth Marsh, Washington, D.C. U.S. Army Corp of Engineers, Baltimore District

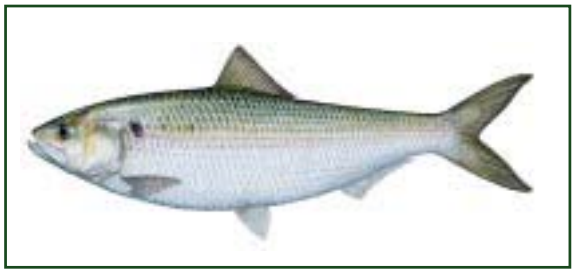
The fish communities of tidal freshwater marshes are complex and change seasonally. These wetlands are used by freshwater, estuarine, marine, and migratory fish. A wide variety of fish species is attracted to freshwater tidal marshes because their dense vegetation and rapid production of detritus provides excellent refuge for juveniles, areas for spawning, and plentiful food resources.

Fish Found in Tidal Freshwater Marshes

American shad *(Alosa sapidissima)*

These migratory fish use tidal freshwater marshes of the Atlantic Coast as nurseries for their young. Juveniles stay in wetland nurseries until the fall, when they move out to sea. Adults later return to the streams where they were hatched to spawn. American shad eat insects, shrimp, worms, and fish.

American shad



Diane Peebles

Atlantic croaker *(Micropogonias undulatus)*

This fish uses tidal freshwater marshes as nursery areas. Adults also visit these wetlands in warmer weather to feed on mollusks, worms, small shrimp, and crabs.

American croaker

Diane Peebles

Chain pickerel *(Esox niger)*

Found along the Atlantic Coast, these fish use tidal freshwater marshes as a food source and as nursery and spawning areas. Chain pickerel's color patterns helps them to use the cover of aquatic plants to hide from their prey. Pickerel scatter their eggs among wetland plants to protect the eggs from predators.

Chain pickerel

Duane Raver

Channel catfish *(Ictalurus punctatus)*

This important sport and commercial fish finds food in tidal freshwater marshes in the Mississippi basin, the Gulf Coast, and many other parts of the country where it has been introduced. This is the catfish most commonly served in restaurants and supermarkets. The catfish scours the bottom of marshes for plant seeds, insects, crawfish, small fish, and other prey. This fish locates food through smell and touch, using whisker-like appendages.

Channel catfish

Duane Raver

Pacific lamprey *(Lampetra tridentata)*

This fish migrates from the open ocean to freshwater to spawn in pools and tidal freshwater marshes. The parasitic adults attach to the sides or bellies of other fish or whales and draw blood and other body fluids for food.

Common Snook *(Centropomus undecimalis)*

This sport fish uses Gulf and Atlantic coasts tidal marshes as a nursery for their young. Adults stay close to shore and eat the crustaceans and small fish that live in marshes.

Common snook

Diane Peebles

For a more comprehensive list of fish found in tidal freshwater marshes, see Appendix A.

Case Study: Tidal freshwater marsh

American eel *(Anguilla rostrata)*

Life history: American eels can be found throughout the Mississippi River basin and in many eastern rivers. Eels spend much of their lives, particularly during winter hibernation, buried in gravel, mud, or rocks. Adept at working their way upstream over or around low falls or dams, eels are thought to sometimes even travel overland on rainy nights. Eels eat a variety of fish, insects, crustaceans, and worms. The eel's acute sense of smell may help it find food. The American eel

American eel

Duane Raver

is a catadromous species, which means it lives in freshwater but returns to saltwater to spawn. These fish stop eating when they leave their freshwater homes to migrate thousands of miles to spawn in the Sargasso Sea, which is part of the Atlantic Ocean east of the Bahamas and south of Bermuda. Eels expend so much energy during their migratory journey that they die soon after they spawn.

Importance of wetlands to American eels: Eels, because of their snakelike movements, are able to navigate in extremely shallow marshy areas. They prefer mangrove roots and other wetland areas, such as marshes and seagrass beds, to hide from predators. They flock to all types of wetlands to eat the abundant small fish, crustaceans, and insect larvae that make wetlands their home. Immature eels often seek winter refuge in tidal and non-tidal wetlands.

Importance of American eels to people: American eels have long been fished for food and sport. Smoked eel is considered a delicacy, especially in Asian and European cultures. Native Americans in the eastern United States would partially dam rivers with stones and then net or spear migrating eels as they were forced through the restricted openings. In addition to their consumptive importance, the American eel has long held a place in myth and speculation. Until the beginning of the 20th century, the location of the eels' spawning grounds and their movements at sea were mysteries.

Status: Recent concerns about declining American eel populations were one factor that led the Atlantic States Marine Fisheries Commission to develop a management plan for the fish. Declines throughout the East Coast are thought to be the result of dams blocking eel migration, loss and degradation of habitats, water pollution, and the appearance of a parasite that has reduced the eel populations in parts of Europe.

Non-tidal Freshwater Marshes

One of the broadest categories of wetlands is non-tidal freshwater marshes. Wetlands included in this category are any non-tidal wetland with soft-stemmed plants rather than trees or shrubs. The vegetated areas generally have no standing water or have shallow water that varies in depth depending on rainfall, but they

Everglades, Florida Kathryn Conant

may contain pools or channels with much deeper water. Non-tidal marshes typically are dominated by floating plants such as water lilies and duckweed, or soft-stemmed plants such as cattails, arrowheads, reeds, and sedges. Non-tidal marshes can be found in low spots in a field or meadow, fringing lakes, and adjacent to rivers.

Non-tidal marshes are found throughout the United States, but some types of non-tidal marshes are associated with specific geographic regions. Prairie potholes are typically found in the northcentral United States and southcentral Canada. Playas are small basins that dry up in the summers and most commonly found in the western and southwestern states. Fens are peatlands found in northern states and mountainous areas. Non-tidal marshes can be found even in the deserts of the southwest, where one-third of fish species are completely dependent on groundwater-fed wetlands and river-side marshes called cienegas.

Some non-tidal marshes support fish and some do not. As a general rule, the deeper the water in the marsh and the more its hydrology is connected with lakes and rivers, the more likely the marsh is to support fish. Non-tidal marshes with little or no standing water support few, if any, fish. Non-tidal marshes with very shallow water often dry up in the summer and/or freeze solid in the winter, making them only temporary homes for fish. If shallow-water non-tidal marshes contain deep pools or are close to a pond, river, or lake, they may contain northern pike, brown bullhead, bluegills, and other fish during certain seasons. However, if these shallow non-tidal marshes are isolated from other bodies of water, large fish probably will not live in them. Some isolated or shallow non-tidal marshes may support killifish and other small fish that can survive the higher temperatures and lower oxygen levels associated with shallow water. Human alteration also impacts fish use of non-tidal marshes. For example, most playas are unavailable as fish habitat because they are farmed or used as a water source for irrigation.

Non-tidal marshes that fringe large water bodies like the Great Lakes provide spawning areas and a food source for many fish such as walleye and muskellunge. Lake Erie supports more fish in terms of numbers and diversity than any of the other Great Lakes, partly because of its extensive system of marshes that provide feeding areas, shelter, and spawning areas to a variety of fish species. Smaller lakes and slow-moving rivers throughout the country also can have fringing marshes that provide essential habitat to many common fish species.

Freshwater Marshes

Bluegill ***(Lepomis macrochirus)***
This heavily fished species lives in shallow water marshes and fens among wetland plants. Males create nests within wetland vegetation and protect eggs until they hatch. Fry remain in marshes and use these wetlands as nursery areas.

Bluegill

Duane Raver

Minnows ***(Cyprinidae)***
These small fish are important food for larger fish, and they use marshes for food and refuge from predators. Some minnows are used by anglers as bait and others are used in laboratories to test pollution levels of industrial discharge to rivers.

Muskellunge ***(Esox masquinongy)***
This popular sport fish is found in heavily vegetated marshes bordering lakes and large rivers. Muskellunge scatter their eggs among aquatic vegetation.

Northern pike ***(Esox lucius)***
This large sport fish spawns in shallow vegetated areas along the borders of lakes and in fens. This fish frequents marshes in search of food. The color pattern of northern pike allows it to hide from its prey among non-tidal marsh vegetation.

White bass ***(Morone chrysops)***
This important commercial and sport fish can be found in shallow and deep portions of water bodies in the Great Lakes and Mississippi River basin regions. White bass spawn in marshes by broadcasting eggs over vegetation in shallow water. This fish also seeks food in marshes.

White bass

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Yellow bullhead ***(Ameiurus natalis)***
One of the most popular bullheads for sportfishing, this fish is native to the Great Lakes and eastern United States, but has been introduced throughout the country. Yellow bullhead visit marshes to eat plant matter, crawfish, aquatic insects, mollusks, and other fish. Males and females make nests in shallow wetlands among plants and roots. Juveniles also use these wetlands as nursery areas.

Yellow bullhead

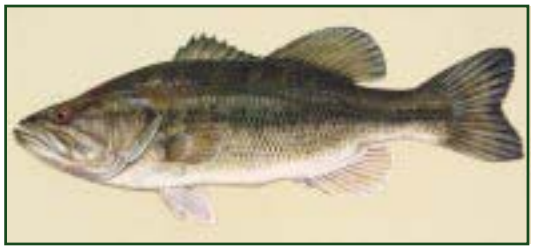
Duane Raver

For a more comprehensive list of fish using non-tidal freshwater marshes, see Appendix A.

Case Study: Non-tidal Freshwater Marsh

Largemouth bass *(Micropterus salmoides)*
Life history: Largemouth bass spawn in late spring to mid-summer. Males build nests for the eggs in shallow water and guard their young for up to two weeks. Juvenile bass leave their nests when they are about a week old and form a small school until they disperse along the shorelines.

Largemouth bass



Duane Raver

Importance of wetlands to largemouth bass: Shallow marshes at the edges of lakes and floodplain wetlands of large, slow-moving rivers are the largemouth's favorite habitat. Wetland vegetation provides cover for largemouth bass and supports its food source. Largemouth take cover among flooded stumps and trees and marsh plants such as water lilies and cattails. Adults move to deep water during the day and return to the shallow water at night to feed on small fish, frogs, and crayfish.

Importance of largemouth bass to people: The largemouth bass is well known by anglers across the country for its excellent fighting ability on the line and its tasty flesh. Largemouth bass is so popular that there are television shows, magazines, clubs, and fishing derbies dedicated to this exceptional fish.

Status: Although the historic range of the fish extended from the Great Lakes region south to Texas and east to the Atlantic Coast, stocking (the release of hatchery-reared fish into an area, largely to support recreational fishing) has spread its range to almost every state.

Forested Wetlands

Forested wetlands are freshwater tidal or non-tidal areas that are vegetated with trees and shrubs. This category includes wetlands in the floodplains of rivers, swamps in the backwaters of slow-moving rivers, pocosins and bogs, and isolated wetlands. Fish use these types of wetlands in a variety of ways. Although mangrove wetlands are forested, they are discussed separately because mangroves are salt tolerant trees that grow along shorelines and support coastal fish populations, while other forested wetlands occur in freshwater areas.

Cypress Swamp in Okefenokee National Wildlife Refuge, Georgia Kathryn Conant

Forested Wetland U.S. Forest Service

Floodplain wetlands

Forested floodplain wetlands are wooded areas adjacent to rivers and are flooded when river water is high. Common forested species include red maple, swamp white oak, northern white cedar, green ash, highbush

cranberry, and buttonbush. Many fish species gain access to forested floodplain wetlands during floods. Fish find valuable food on the forest floor and use the shallow water areas to spawn. In the eastern United States, about half of the fish species found within the lower Mississippi River use the floodplain as a nursery and spawning ground. The majority of southern freshwater fish, including bass and sunfish, lay eggs in the shallow water of forested floodplain wetlands. Likewise, after swimming upstream from the ocean, shad spray their eggs over the submerged vegetation in forested wetlands. Once the eggs hatch, the larvae must find food from the surrounding environment, so the plentiful food supply of detritus found in forested floodplain wetlands is an advantage. The vegetation also protects young fish from predators.

Use of forested floodplains by fish varies throughout the United States. Streams in the arid west often have running water only during wetter times of the year. However, forested floodplain wetlands in the Northwest are particularly important to Pacific salmon species. Large woody debris from the riverside wetlands dam sloughs or slow-moving streams and enhance salmon habitat. Strong water currents during the rainy season send young Coho salmon to seek shelter in forested floodplain wetlands. Many salmon species take advantage of the shelter and abundant food supply of forested floodplains by using them as nursery areas. That wetland connection offers a special challenge to resource managers trying to nurture populations of endangered or threatened Pacific or Atlantic salmon back from the brink of extinction.

Backwater swamps

In contrast to forested floodplain wetlands that are temporary, backwater swamps usually retain water even after floodwater recedes, which means they can serve as habitat for fish that do not return to the stream channel. While floodplain wetlands generally support hardwoods such as maples, oaks, and ash, the typical vegetation of backwater swamps includes bald cypress, water tupelo, and black gum. These backwaters are less than optimal for aquatic life because of fluctuating water levels and low dissolved oxygen levels. Bowfin, gar, and some minnows are able to handle these living conditions because they can breathe oxygen from the air. In general, small fish dominate backwater swamps while larger fish generally use these areas during floods.

Peatlands

Bogs, pocosins, and Carolina Bays are types of peatlands. Mosses are the most distinguishing feature of peatlands, and are what forms the “peat” in these wetlands. Fens are also peatlands, but are typically dominated by herbaceous plants; therefore, fens are discussed with the non-tidal freshwater wetland group rather than here. Bogs and pocosins are the best-known examples of wetlands whose soils are a mixture of partially decayed plant matter called peat. These wetland types vary in their vegetation, connection to other water sources, availability of nutrients needed for plant growth, and acidity. Despite the harsh conditions found in some peatlands, many do support fish.

Bogs form in old lake basins or depressions in the landscape and are found largely in the northern United States. Bogs get their water from rain, because they are usually isolated from groundwater and surface water. The ground may appear solid, but it is often nothing more than a floating mat of sphagnum moss that quakes underfoot. The sphagnum moss and the peat produce an acidic substance, making some bogs inhospitable to fish. Less acidic bogs may provide habitat for gamefish such as pike, walleye, bluegill, and smallmouth bass.

Pocosins and Carolina Bays are bog-like wetlands found from Virginia to northern Florida, with the majority located in North Carolina. The most obvious difference between pocosins of the Southeast and the bogs of the North is the vegetation. Pocosins are dominated by evergreen shrubs and trees, while bogs have mostly mosses and fewer trees. The word “pocosin” comes from the Algonquin Native American phrase “swamp on a hill.” Indeed, these wetlands are often found on high areas of a flat, water-logged, acidic, and nutrient-poor landscape. Some of the fish found in pocosins are thought to have evolved from saltwater fish species that occupied these areas when sea levels were higher. Other fish species found in pocosins originate from nearby streams or lakes. Occasional drying of these wetlands in the summer or low oxygen levels in the winter can cause fish kills, so pocosins in close proximity to another water source are more likely to be recolonized during floods. Some game species found in pocosins include redfin pickerel, yellow perch, warmouth, flier, black crappie, bluegill, and largemouth bass.

Carolina Bays are small lakes found among the riverside forested wetlands of the Atlantic Coastal Plain that extend from North Carolina to Georgia. These bays are surrounded by or overgrown with marshes and forested wetlands. Small fish such as killifish, darters, and minnows thrive in the thick cover of vegetation these bays provide.

Fish Found in Forested Wetlands

Alewife ***(Alosa pseudoharengus)***
This important commercial species migrates up rivers and small streams to spawn in quiet backwater wetlands. Young alewife swim downstream to lakes or the ocean in the winter. People enjoy alewife smoked, dried and salted, and fried. This fish also is used for crab and lobster bait. Alewife and blueback herring, another wetland-dependent fish, are related species that often are grouped together as river herring.

Atlantic needlefish ***(Strongylura marina)***
Found throughout the Atlantic and Gulf coasts and non-tidal regions, this fish takes advantage of insects and other food sources found on forested floodplains.

Bowfin ***(Amia calva)***
This eastern U.S. fish species lives in swamps with dense vegetation. Males create nests in the shallow water of forested wetlands by tearing out vegetation and making a trench among the roots. For a week after hatching, fry seek shelter in the wetlands by attaching an adhesive organ in their snout to vegetation. If the dissolved oxygen in the slow-moving wetland water becomes too low, bowfin can breathe oxygen from the air.

Bowfin

Duane Raver

Crawfish ***(Procambarus spp.)***
Resembling small lobsters, these crustaceans have well-developed claws and a broad, flattened tail that serves as an oar. Crawfish burrow into the mud along floodplains of stream and other forested wetlands to reach water below the surface. During floods, they emerge to take advantage of abundant food resources. Found along the Southeast Coast and the Gulf Coast, crawfish also use forested wetlands as nursery areas and for spawning.

Darters ***(Etheostoma spp.)***
This group of fish lives in clear, swift-moving rivers in the eastern United States. Darters use forested wetlands along streams for spawning and nursery areas. Some darters have adapted to live in the slow, low-oxygenated waters of floodplain wetlands.

Paddlefish ***(Polyodon spathula)***
Found within the Mississippi River basin and the rivers of the Gulf Coast, paddlefish use forested wetlands for nursery areas. This fish gets its name from its large paddle-shaped snout. Paddlefish are fished commercially for their eggs, which are consumed as caviar.

Paddlefish

Duane Raver

For a more comprehensive list of fish using forested wetlands, see Appendix A.

Case Study: Forested Wetland

Alligator gar *(Lepisosteus spatula)*
Life history: Alligator gars are found along the Gulf Coast and into the Mississippi River valley. This fish species is a classic lie-in-wait predator, ambushing and eating turtles, waterfowl, other fish, and small mammals. Gars spawn during spring flooding when they have access to flooded lowland swamps. Gars may live up to 60 years.

Alligator gar

Duane Raver

Importance of wetlands to alligator gars: Backwater wetlands are prime habitat for gars. Alligator gars time their reproduction cycles to coincide with flooding so they can lay eggs in vegetated shallows. Adults typically live in pools and slow-moving waters of rivers, swamps, bayous, and lakes. Gars have adapted to low oxygen levels by using their swim bladder, an organ that allows a fish to have buoyancy, as a lung. Alligator gars intake air from above the water's surface into the swim bladder, which transfers oxygen directly into surrounding blood vessels.

Importance of alligator gars to people: These sport fish are highly sought for their firm white flesh.

Status: Some state fish and game agencies have limited angling for alligator gars to relieve decreasing populations.

Explore and Learn

This chapter has described a variety of wetland types and provided examples of how different fish may be utilizing them. More information on the fish that rely on local wetlands can be found in Appendix A or by asking local experts. However, the best way to find out about fish populations is to explore the area. Fact finding can be accomplished by fishing, asking other anglers, and talking to your state fisheries biologists.

If your wetland seems to lack a fish population, go back at different times of the year to see if fish have seasonal access to the area. Also keep in mind that fish do not have to live in or even visit a wetland to reap the benefits that it offers. Knowing that your local wetlands are important to fish should help you get others in your community excited about their conservation. Remember, whether or not fish are living in a particular wetland, its protection can be vital to fish survival.

Case Study: General

White Sturgeon *(Acipenser transmontanus)*
Life history: White sturgeon is a large anadromous fish found along the West Coast and inland. Sturgeon use fleshy whisker-like appendages and taste buds along the outside of their mouths to search stream and brackish wetland bottoms for insect larvae, snails, worms, small fish, and crustaceans. Males may take 12 years to reach maturity and females take up to 20 years or longer. Sturgeons are experiencing over fishing and threats to their habitat, resulting in a younger average age and fewer individuals living to sexual maturity. In the early 1900s, catching 800 to 1,000 pound white sturgeon was common, which is now unusual. Females can produce as many as four million eggs at a time and may spawn only once every two to eight years.

White sturgeon spawn predominantly in three large river systems: Sacramento-San Joaquin River system in California, the Columbia River system in the Pacific Northwest, and the Fraser River system in British Columbia, Canada. The current migration range is not as extensive as its historic range because of human-caused barriers. Unlike Pacific salmon, white sturgeon cannot jump forward, so it is difficult for them to get over small obstacles such as low dams and culverts. Currently, there are eighteen landlocked (non-migratory) populations of white sturgeon throughout western North America. Some of these populations are isolated because of natural barriers formed during the last glacial age (approximately 10,000 years ago). Unfortunately with the development of dams on many sturgeon-inhabited streams, additional barriers were formed, limiting migration paths even more. These landlocked populations have adapted to a non-migratory life cycle.

Importance of wetlands to sturgeon: Sturgeons rely on wetlands for spawning and nursery areas. Juveniles may spend several years in tidal freshwater wetlands before migrating to the ocean, feeding on shellfish and insect larvae. Adult sturgeons visit freshwater marshes to feed on schools of smaller foraging fish.

Importance of sturgeon to people: Sturgeon historically have been and continue to be valuable commercial fish. They are so valued that English kings and queens once decreed that sturgeon could be served only at the royal table. Sturgeon are caught for their meat, to produce fine oil, and for their eggs, which are considered prized caviar. The swim bladder is used to clarify white wines, make special glues, and manufacture water-proofing materials.

Status: Dams, pollution, habitat destruction, and overfishing have greatly reduced both the numbers and the geographic ranges of sturgeon. Sturgeon declines have become so serious that many species, including pallid, shortnose, and Gulf sturgeon have been added to the endangered or threatened species list. A naturally landlocked population of white sturgeon in Montana and Idaho is also listed as endangered.

Becoming a Wetland Steward

Fish conservation cannot happen without your help. As a nation, the United States has taken the first strides to preserve clean water, conserve wetlands and other valuable habitat, and conserve native fish populations. Additional wetland legislation, education, and conservation are needed to preserve the delicate balance of land, air, water, aquatic life, and other wildlife needed to sustain fish, wildlife, and people.

Fish and Wetland Conservation Through Legislation

Many legislative programs have been enacted to address wetland and fish protection and restoration. The best known legislation is the Clean Water Act (CWA), which seeks to improve water quality by maintaining and restoring the physical, chemical, and biological integrity of the nation's waters. Although the CWA has helped to reduce the amount of sewage and toxic chemicals entering waterways, its two major goals of making our nation's waters fishable and swimmable have not yet been realized. Pollution prevention and habitat restoration are important steps toward achieving the goal of fishable and swimmable waters.

One of the oldest examples of fish conservation legislation is the Federal Aid in Sport Fish Restoration Act, which was enacted in 1950. Commonly known as "Dingell-Johnson," the legislation channels the dollars of America's anglers directly into the restoration and management of fishery resources in the United States. This act applies an 11 percent manufacturers' excise tax on fishing rods, reels, creels, artificial baits, lures, and flies. The revenue is distributed to the states to conduct research, purchase access to fishing areas, build boating access sites, and maintain other projects that benefit fish and anglers. This act was amended in 1984 and 1991 to expand the revenue sources to implement fisheries restoration. The amendments, commonly called "Wallup-Breaux," support increased boating access, aquatic resources education programs, and coastal wetlands restoration as a way to improve nursery habitat for marine sport fish.

More recent legislation that identifies and helps protect important fish habitat is the Magnuson-Stevens Fishery Conservation and Management Act amended 1996. This legislation authorizes the National Marine Fisheries Service, working with regional Fishery Management Councils, to designate "essential fish habitat" (EFH) for federally managed marine species. For many species and life stages, wetlands comprise an important component of EFH.

States and local governments also have an important role in wetland conservation. However, because of the large amount of information in this area, we did not try to summarize all the important state and local legislation that builds upon the conservation provided by the Federal legislation. Many states are implementing new innovative programs to help reduce wetland degradation and we encourage you to contact your local or state government to get information on their wetland protection and restoration programs.

Citizen Action

Although national and state legislation has played an important role in protecting and restoring fish habitat, partnerships and community involvement are essential to continued success. It is important that citizens, government, businesses, and other interested partners work together to protect fish habitat.

The U.S. Department of the Interior, U.S. Department of Agriculture, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, and the National Oceanic and Atmospheric Administration (NOAA) are among the agencies that have wetland restoration programs that benefit fish populations. One program that specifically targets fish habitat restoration and involves citizen action is NOAA's Community-based Restoration Program (CRP). Since establishment in 1996, NOAA and its partners have supported grassroots efforts to address important fishery habitat concerns across coastal America by providing seed money and technical expertise. For example, CRP supports "Pepper Busters," a volunteer project coordinated by the Marine Resources Council of East Florida. Volunteers remove invasive Brazilian pepper trees from mangrove wetlands. Since their

introduction as an ornamental tree, Brazilian pepper trees have proliferated in mangrove swamps where they produce thick shade that kills slower-growing plants below and releases compounds that inhibit the growth of other plants. As Brazilian pepper trees strangle mangrove stands whose submerged roots provide vital fish habitat, fish populations suffer. After removing Brazilian pepper trees, volunteer Pepper Busters plant mangrove seedlings. In one day, volunteers restored enough mangrove fish habitat to support three million fish during the life of the vegetation. In fact, through this project, volunteers restore more than three miles of shoreline each year. For another excellent example of how volunteer involvement in wetland restoration can benefit fish habitat, read the case study for the Tampa Bay estuary in this section.

In addition to restoring degraded wetlands, volunteers and landowners can play an important role in protecting existing wetland fish habitat. In New Hampshire, the Great Bay Resource Partnership was organized in 1994 to support the North American Waterfowl Management Plan and Wetland Conservation Act. A broad mix of non-profit conservation organizations, citizens, and government agencies formed this partnership to protect the Great Bay Estuary located in the southeastern portion of the state. This estuary is 4,500 acres of crucial habitat for fish, waterfowl, and other wildlife species. The partnership works with landowners on a voluntary basis to identify and implement conservation options for their land. This part of New Hampshire is facing heavy development pressures, and the partnership is working to ensure that important wetland habitat is not destroyed in the process. To date, the partnership has protected several hundred acres around the Great Bay.

Case Study: Volunteers Help Grow and Plant Salt Marsh

The Tampa Bay estuary is located along Florida's Gulf of Mexico coast and supports a diversity of wetlands and fish. Common shellfish and fish that use the tidal salt marshes include crabs, shrimp and marine juvenile fish. Unfortunately, shoreline development and other human activities have significantly altered the estuarine ecology, and destroyed almost half of the historic mangroves and salt marshes. In response, the Tampa BayWatch organization was formed to monitor, protect, and restore the Tampa Bay marine and wetland system.

Tampa BayWatch supports wetland restoration efforts through the construction and maintenance of nurseries to grow salt marsh plants. Wetlands plants are grown from local seeds that have adapted to the Tampa Bay estuarine environment. The organization then works with other ongoing restoration efforts to plant the salt marsh grasses at appropriate restoration sites. The nursery plants provide an inexpensive source of native plants for many federal, state, county, and city restoration projects throughout the Tampa Bay estuary. Schools and local scientists help monitor salinity, temperature, and plant growth of the newly planted wetlands.

Support and funding for this initiative has come from a variety of sources. Area middle and high schools partner with Tampa BayWatch through their science and ecology clubs. The volunteer students help plant and raise the young plants, providing the students with educational opportunities on ecology and agricultural practices. These volunteers also help plant the wetland plants. Program support has been provided from a wide range of sources including private companies and citizens, the state of Florida, the Southwest Florida Water Management District, the National Estuary Program, and National Oceanic and Atmospheric Administration (NOAA) through its Community-based Restoration Program.

You Can Make a Difference

There are many things that you can do in your community to raise awareness about the interconnectedness of fish and wetlands and to take an active role in their protection and restoration.

Some possibilities include:

- **Join a local conservation organization (see resources section for examples).**
- **Sponsor a wetland tour with a local expert to raise awareness about the ecological importance of wetlands, particularly to fish.**
- **Become involved in community land-use planning to prevent wetland destruction.**
- **Provide assistance to local efforts to protect and restore wetlands and fish populations.**
- **Urge others to join the effort to protect wetlands as important fish habitat.**
- **Restore wetlands by planting native vegetation with the help of local ecologists.**
- **Monitor the health of local wetlands.**

- **Share this publication with friends, family, and other people who care about fish and their habitat needs in your community.**

Community-based projects and educational programs are essential to the continued existence of fish and shellfish populations as well as the wetlands they call home. Your efforts to conserve, protect, and restore wetlands and other valuable fish habitat will have a lasting positive effect on the entire ecosystem and your community.

Planting Saltmarsh, Prall's Island, New York NOAA

Resources

Government Contacts

These agencies have regional, and in some cases, state and local offices. Call or visit their websites for more information. State environmental, natural resources, and fish and wildlife offices also are good sources of information. Local contact information is available on the Internet or in local phone books.

National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Office of Habitat Conservation
1315 East-West Hwy
Silver Spring, MD 20910
(301) 713-2325
www.nmfs.noaa.gov/habitat

National Park Service
Water Resources Division
1849 C Street, NW
Washington, DC 20013
(202) 208-4747
www.nps.gov

National Sea Grant College Program
NOAA/OAR/R/SE Room 11708
SSMC3
1315 East-West Highway
Silver Spring, MD 20910-3226
(301) 713-2431
www.oar.noaa.gov/organization/programs/sgcolleges.html

Natural Resources Conservation Service
(formerly the Soil Conservation Service)
Watersheds and Wetlands Division
P.O. Box 2890, Washington, DC 20013
(202) 720-3210
www.nrcs.usda.gov

U.S. Army Corps of Engineers
Regulatory and Planning Divisions
441 G Street, NW
Washington, DC 20314
(202) 761-0008
www.usace.army.mil

U.S. Environmental Protection Agency
Office of Wetlands, Oceans, and Watersheds
401 M Street, SW
Washington, DC 20460
(202) 260-2090
www.epa.gov

U.S. Forest Service
Watershed and Air Management
PO Box 96090
Washington, DC 20090-6090
(202) 205-1475
www.fs.fed.us

U.S. Fish and Wildlife Service
National Fisheries Program or Division of Habitat Conservation
4401 North Fairfax Dr.
Arlington, VA 22203
(703) 358-1715 or 358-2183
www.fws.gov

U.S. Geological Survey
Water Resources Division
John W. Powell Federal Building
12201 Sunrise Valley Drive
Reston, VA 20192
(888) 275-8747
www.usgs.gov

Non-governmental Organizations

Many of these organizations have local chapters. Find local chapters and other local organizations by contacting these national offices, using the Internet, or looking in your phone book.

American Fisheries Society
5410 Grosvenor Lane, Suite 110
Bethesda, MD 20814
(301) 897-8686
www.fisheries.org

American Sportfishing Association
1033 N. Fairfax St., Suite 200
Alexandria, VA 22314
(703) 519-1872
www.asafishing.org

Association of State Wetland Managers
P.O. Box 269, 1434 Helderberg Trail
Berne, NY 12023
(518) 872-2171
www.aswm.org

Ocean Conservancy
1725 DeSales St., NW, Suite 600
Washington, DC 20036
(202) 429-5609
www.oceanconservancy.org

Ducks Unlimited
One Waterfowl Way
Memphis, TN 38120
(901) 758-3825
www.ducks.org

FishAmerica Foundation
1033 North Fairfax St., Suite 200
Alexandria, VA 22314
(202) 543-5509
www.fishamerica.org

Izaak Walton League of America
Save Our Streams Program
707 Conservation Lane
Gaithersburg, MD 20878
(800) BUG-IWLA (284-4952)
www.iwla.org

Marine Fish Conservation Network
660 Pennsylvania Ave., SE Suite 302B
Washington, D.C. 20003
202-543-5509
www.conservfish.org

National Audubon Society
666 Pennsylvania Ave., SE
Washington, DC 20003
(202) 547-9009
www.audubon.org

Project WET (Water Education for Teachers)
201 Culbertson Hall
Montana State University
P.O. Box 170575
Bozeman, MT 59717-0575
(406) 994-5392
www.montana.edu/wwwater

Restore America's Estuaries
www.estuaries.org

Sierra Club
730 Polk St.
San Francisco, CA 94109
(415) 977-5500
www.sierraclub.org

Society of Wetland Scientists
PO Box 1897
Lawrence, KS 66044
(601) 634-2942
www.sws.org

The Nature Conservancy
4245 North Fairfax Drive
Suite 100
Arlington, VA 22203-1606
(800) 628-6860
www.tnc.org

The Watercourse Program
201 Culbertson Hall
Montana State University
P.O. Box 170575
Bozeman, MT 59717-0575
(406) 994-5392
www.montana.edu/wwwater

Trout Unlimited
1500 Wilson Blvd., Suite 300
Arlington, VA 22209-2404
(703) 522-0200
www.tu.gov

Wildlife Forever
10365 West 70th Street
Eden Praire, NM 55344
(952) 833-1522
www.wildlifeforever.com

Books and Pamphlets

Fisheries, Wetlands and Jobs: The Value of Wetlands to America's Fisheries, 1998. 28-page report on the economic importance of fisheries and the importance of wetlands to fish. Source: Clean Water Network, 1200 New York Ave., Suite 400, Washington, DC 20005, (202) 289-2395, cleanwaternt@igc.apc.org, ($5.00 or view on line at www.cwn.org).

The Economic Importance of Sport Fishing, 1996. This 10-page booklet provides economic data on sport fishing throughout the United States. Source: American Sportfishing Association, 1033 N. Fairfax St., Alexandria, VA 22314, (703) 519-9691, info@asafishing.org, www.asafishing.org. (Free).

Handbook for Wetlands Conservation and Sustainability, 1998. This 288-page book provides information on wetland ecology, functions and values, and stewardship projects. Includes monitoring instructions and data forms for plants, soils, hydrology, wildlife, and human impacts to wetlands. Source: Izaak Walton League, 707 Conservation Lane, Gaithersburg, MD 20878, (301) 548-0150; (800) BUG-IWLA (284-4952), www.iwla.org, ($38.50 plus shipping).

Wetland Fact Sheets. Source: Environmental Protection Agency's Wetlands Information Hotline, (800) 832-7828.

Periodicals

National Wetlands Newsletter. Focuses on research and education about wetland policy, law, and management. Source: Environmental Law Institute, 1616 P St., NW, Second Floor, Washington, DC 20036, (800) 433-5120, ($48 for 6 issues).

Wetland Journal. Concentrates on wetland issues, education, restoration techniques, research, and horticulture. Source: Environmental Concern, Inc., P.O. Box P, 210 W. Chew Ave., St. Michaels, MD 21663, (410) 745-9620, www.wetland.org, ($34 per year).

Educational Materials

Aquatic Project Wild. Curriculum for K-12 with supplemental materials about wetlands and related topics. Source: Project WILD, 707 Conservation Lane, Gaithersburg, MD 20878, (301) 527-8900, (price varies).

Discover Wetlands. Wetland activities form a unit or are used with existing curricula. Source: Washington State Department of Ecology, Mail Stop PV-11, Olympia, WA, (206) 438-7538, ($11.50).

WOW! Wonders of Wetlands. K-12 curriculum with classroom and outdoor activities. Source: Environmental Concern, Inc., P.O. Box P, 210 West Chew Ave., St. Michaels, MD 21663, (410) 745-9620, www.wetland.org, ($17).

State Fish Art Project Lesson Plan: Something's Fishy. Short curriculum on fish biology and ecology for grades 4-12. Illustrations and descriptions provided for state fish of each state. Instructions and entry form for state fish artwork and essay contest. Source: Wildlife Forever, 10365 West 70th Street, Eden Prairie, MN 55344, (612) 833-1522, www.wildlifeforever.org or www.statefishart.com. (Free).

Field Guides

A Field Guide to Atlantic Coast Fishes: North America (Peterson Field Guides), 1986. Houghton Mifflin Co. ISBN 0395975158.

A Field Guide to Pacific Coast Fishes (Peterson Field Guides), 1983. Houghton Mifflin Co. ISBN 061800212X.

A Field Guide to Freshwater Fishes, 1998. Houghton Mifflin Co. ISBN 0395910919.

Glossary

Anadromous: Describes fish that spend most of their lives in the sea and migrate to freshwater to spawn.

Bog: Wetland type that forms in old lake basins or depressions in the landscape and is characterized by acidic, nutrient poor, peat soils; typical vegetation includes sphagnum moss, woody shrubs, and carnivorous plants.

Brackish: Water containing some salt.

Catadromous: Describes fish that spend most of their lives in freshwater and migrate to saltwater to spawn.

Cienegas: Southwestern term for wetlands near rivers or fed by springs that are dominated by sedges and other herbaceous and woody wetland plants.

Detritus: Dead and decomposing plant and animal material.

Ecosystem: A community of plants and animals interacting with one another and with their physical environment.

Endangered: As defined under the Federal Endangered Species Act, a species is considered endangered if it is in danger of extinction throughout all or a significant portion of its range.

Estuary: A semi-enclosed body of water with an open connection to the sea, where saltwater and freshwater mix.

Fen: Peat-accumulating wetland fed by groundwater that forms at low points in the landscape or on slopes; water levels are fairly constant all year; dominated by soft-stemmed plants, such as grasses and sedges.

Finfish: Fish with fins, gills, streamlined bodies, and no shells.

Fishery/Fisheries: The act, process, and industry of catching fish, crustaceans, mollusks, or other aquatic animals for commercial, recreational, subsistence or other purposes.

Floodplain: The flat area of land adjacent to a stream that stores and dissipates floodwater.

Food web: Elaborate, interconnected feeding relationship in an ecosystem.

Fry: A young, recently hatched fish.

Microbes: Minute lifeforms such as bacteria.

Peat: Partially decomposed plant matter.

Peatlands: Wetlands that accumulate peat.

Pocosins: Evergreen shrub bogs found on the Coastal Plain of the southeastern United States, typically found on high areas of a flat, water-logged, acidic, and nutrient-poor landscape.

Prairie potholes: Marsh-like ponds that have formed in shallow basins caused by the retreat of glaciers in the northcentral United States and southcentral Canada; water levels fluctuate seasonally and they can be dry for several years.

Salinity: Measure of the salt content of water or other liquids.

Shellfish: Any aquatic animal that has a shell, such as crustaceans and mollusks.

Subsistence fishery/fisheries: A fishery in which the harvested resource is used directly without sale for profit; not considered a leisure or sporting activity.

Spawn/Spawning: Process of releasing and fertilizing eggs.

Threatened: As defined under the Federal Endangered Species Act, a species is considered threatened if it is likely to become an endangered species.

Tidal: Pertaining to, affected by, or having tides.

Watershed: An area of land that drains to a particular body of water.

Wetland: A vegetated ecosystem transitional between water and land that is covered with water or has very wet soils for some part of the year.

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Appendix A
More Fish Species Found in Wetlands

For each wetland type discussed in "Which Fish Use My Wetlands?" there is a corresponding table that lists many of the fish that utilize that type. For each fish, the tables include interesting facts about its life history, unique value, regions of the country where it is found, and ways it utilizes the specific wetland. This table divides the ways fish use wetlands into the following categories:

- **Food** - adults eat wetland plants or animals
- **Nursery** juveniles grow into adulthood in the wetlands, eating plants or animals and finding refuge
- **Refuge** - adults seek refuge in the wetland
- **Spawing** - adults lay their eggs in the wetland.

In some cases, these uses are clarified in the "Facts of Interest" column. For a description and map of the regions used in the tables, see the section titled "Which Fish Use My Wetlands." Please note that many more species of fish use some of these wetland types than we have room to list in this document.

Fish Found in Seagrass Beds

Fish Species	Interesting Facts	Regions	Use
American eel *Anguilla rostrata*	Migrate from freshwater to the saltwater of the Sargasso Sea to spawn. Juveniles return to grow up in freshwater wetlands.	Northeast; Southeast	Food; Nursery; Refuge
American lobster *Homarus americanus*	Use two large front claws to catch and crush fish, worms, crabs, and other food.	Northeast; Southeast	Food; Nursery; Refuge
Atlantic croaker *Micropogonias undulatus*	Frequent seagrass beds when weather is warm to eat small shrimp, crabs, mollusks, and worms.	Northeast; Southeast; Gulf Coast	Food; Nursery; Refuge
Atlantic herring *Clupea harengus*	These important commercial fish are eaten fresh, pickled, or smoked.	Northeast; Southeast	Food; Nursery; Refuge
Atlantic stingray *Dasyatis sabina*	These small, tropical rays live in shallow coastal waters and eat small crustaceans and invertebrates found in seagrass beds.	Southeast; Gulf Coast	Food
Atlantic thread herring *Opisthonema oglinum*	Filter plankton and eat small fish, crabs and shrimp.	Northeast; Southeast;	Food; Nursery; Refuge
Bay scallop *Argopecten irradians*	Attach to seagrass blades as juveniles before settling on the bottom.	Northeast; Southeast; Gulf Coast	Food; Nursery Refuge Spawning
Black sea bass *Centropristis striata*	Usually just called sea bass; also known in some regions as hannabill, black Harry, talywag, and black Will. Eat small fish and crustaceans.	Northeast; Southeast	Food; Nursery Refuge
Blue crab *Callinectes sapidus*	Young crabs and molting adults depend on seagrass deds and coastal marshes for food and refuge from pedators, Adult blue crab visit grassy, shallow bays to eat smaller crabs, clams, seaweed and dead fish.	Northeast; Southeast	Food; Nursery Refuge
Blue fish *Pomatomus saltatrix*	Feed on smaller fish in eelgrass beds. Bluefish travel in schools and prefer warm water. Polular sport fish.	Northeast; Southeast	Food; Nursery
Bonefish *Albula vulpes*	Feed on crustaceans and worms in shallow areas. Tails may break water surface while they feed.	Northeast; Southeast: Pacific	Nursery
Brown Shrimp *Penaesus aztecus*	Shrimp proudction has been linked to amount of of wetlands acres and amount of edge between wetlands and open water.	Northeast; Southeast; Gulf Coast	Food; Nursery; Refuge

Fish Species	Interesting Facts	Regions	Use
Californa halibut *Paralichtys californicus*	It is the largest and most abundant flatfish within its range, though greatly smaller than the more northerly Pacific halibut.	Pacific	Food; Nursery Refuge
California skate *Raja inornata*	Lives on in-shore mudflats.	Pacific	Food;Nursery Refuge
Chum salmon *Oncorhynchus keta*	Adults live in saltwater but return to freshwater to reproduce. Young salmon rest in seagrass they become adjusted to saltwater.	Pacific; Alaska	Food; Nursery
Dungeness crab *Cancer magister*	Larvae ride tidal currents to get from offshore to salt marshes and seagrass beds, where they grow to adulthood. Larvae also ride jellyfish to inshore waters.	Pacific; Alaska	Nursery; Refuge
English sole *Pleuronectes vetulus*	Eat crustaceans, worms, and other small aquatic animals. Marketed as filet of sole.	Pacific; Alaska	Food; Nursery; Refuge
Gag *Mycteroperca microlepis*	Juveniles live in estuaries and seagrass beds and eat crustaceans that live in grass beds. Adults are usuallyfound offshore or inshore on rocky or grassy bottoms.	Southeast	Food; Nursery; Refuge
Gobies *Gobiidae*	A diverse group of fish that feeds mostly on invertebrates or algae. Females lay eggs over vegetation and males fertilize and guard eggs.	Northeast; Southeast	Nursery; Spawning
Gray snapper *Lutjanus griseus*	Spend early life sheltered in mangrove swamps and seagrass beds.	Southeast	Food; Nursery; Refuge
Grunts *Haemulidae*	Medium-size, perch-like sport fish that make grunting sounds with teeth.	Northeast; Southeast	Food; Nursery
Hard clam *Mercenaria mercenaria*	Juveniles attach to seagrass blades before settling on the bottom. Adults burrow into bottom mud.	Northeast; Southeast	Food; Nursery; Refuge
Lingcod *Ophiodon elongatus*	Adult lingcod feed and seek shelter in shallow, inter-tidal areas of bays near seagrass beds.	Pacific; Alaska	Food
Northern anchovy *Engraulis mordax*	Important commercial fish and the main food source for many seabirds.	Alaska	Food; Nursery; Refuge; Spawning
Pacific angel shark *Squatina californica*	Reproduce via aplacental viviparity with litters of 8-13 live-born pups.	Pacific	Food; Nursery; Refuge
Pacific herring *Clupea pallasi*	Spawning takes place in shallow shoreline wetlands close to vegetation. Fertilized eggs attach to marsh grasses, eelgrass, and algae.	Pacific	Spawning
Pacific tomcod *Microgadus proximus*	Eat shrimp, mussels, and other small fish. Adults frequent deep water while young stay in the shallows.	Pacific	Nursery
Permit *Trachinotus falcatus*	Bottom feeders that eat small fish and crustaceans. Feed in seagrass beds at high tide. Popular sport fish.	Northeast; Southeast; Gulf Coast	Food; Nursery; Refuge
Pigfish *Orthopristis chrysoptera*	Schooling fish that feed on crustaceans and smaller fish, mainly at night.	Northeast; Southeast; Gulf Coast	Food; Nursery; Refuge
Pinfish *Lagodon rhomboides*	Can feed directly on seagrass blades.	Southeast; Gulf Coast	Food; Nursery; Refuge
Pink shrimp *Penaeus duorarum*	Shrimp production has been linked to amount of wetland acres and amount of edge between wetlands and open water.	Northeast; Southeast; Gulf Coast	Food; Nursery; Refuge
Queen conch *Strombos gigas*	Feed on other invertebrates and directly on seagrass blades.	Southeast	Food; Nursery

Fish Species	Interesting Facts	Regions	Use
Rainbow Smelt *Osmerus mordax*	Small relative of trouts, rainbow smelt is often caught by ice fishing.	Northeast; Southeast; Great Lakes	Food; Nursery Refuge
Red drum *Sciaenops ocellatus*	These commercial and recreational fish eat crabs and shrimp that use seagrass beds.	Northeast; Southeast; Gulf Coast	Food; Nursery Refuge
Redfin parrotfish *Sparisoma rubripinne*	Feed on seagrass blades and animals that live on the blades. Parrotfish are able to change sex.	Southeast	Food; Nursery
Scup *Stenotomus chrysops*	Eat small fish, crustaceans, and sometimes seagrass blades.	Northeast; Southeast	Food; Nursery; Refuge; Spawning
Sea bream *Archosargus rhomboidalis*	Commonly found over mud bottoms in mangrove sloughs and on vegetated sand bottoms. Feed on small bivalves, crustaceans, and plant material.	Southeast	Food; Nursery; Refuge
Sheepshead *Archosargus probatocephalus*	Flat front teeth that protrude beyond the lips make these fish look like sheep.	Southeast	Food; Nursery; Refuge
Shiner perch *Cymatogaster aggregata*	In general, the sperm remain inactive in the ovary of the female fish for about5-6 months after mating.		Food; Nursery; Refuge
Silver perch *Bairdiella chrysoura*	Found in coastal waters over sandy and muddy bottoms. Moves to wetland nursery and feeding areas in estuaries during summer.	Southeast	Food; Nursery; Refuge
Silverstripe halfbeak *Hyporhamphus unifasciatus*	Related to the flying fish. Although they do not glide through the air, they feed on the surface.	Northeast; Southeast; Pacific	Food; Nursery; Refuge
Snook *Centropomidae*	Staying close to shore, these sport fish eat crustaceans and small fish.	Southeast; Gulf Coast	Nursery; Spawning
Spot *Leiostomus xanthurus*	Pan-sized drum, popular with bridge and pier anglers.	Northeast; Southeast; Gulf Coast	Food; Nursery; Refuge
Spotfin mojarra *Eucinostomus argenteus*	Jaws extend into a short tube used to suck worms and other invertebrates from the bottom.	Gulf Coast	Food; Nursery; Refuge
Spotted seatrout *Cynoscion nebulosus*	Juveniles live in shallow, grassy areas including seagrasses and salt marshes.	Northeast; Southeast; Gulf Coast	Food; Nursery; Refuge; Spawning
Striped mullet *Mugil cephalus*	Live over shallow, muddy bottoms and eat by scooping mouthfuls of mud and digesting tiny plants as the mud passes through the gut.	Northeast; Southeast; Pacific; Gulf Coast	Food; Nursery; Refuge
Striped seaperch *Embiotoca lateralis*	Often living and feeding in coastal wetlands, perch rear their young among aquatic vegetation.	Pacific	Food; Nursery; Refuge
Southern puffer *Sphoeroides nephelus*	Eat crustaceans and other fish and prefer protected coastal waters.	Northeast; Southeast; Gulf Coast	Food
Southern stingray *Dasyatis americana*	Burrow in sand during the day and forage in seagrass beds at night. Eat bivalves, worms, crabs, shrimp, and small fish.	Southeast; Gulf Coast	Food
Summer flounder *Paralichthys dentatus*	Juveniles and adults live in the creeks within salt marshes and seagrass beds.	Northeast; Southeast	Food; Nursery; Refuge
Surf smelt *Hypomesus pretiosus*	Important food for larger sport fish. Young live offshore and adults move back inshore to feed among seagrass beds.	Pacific; Alaska	Food; Refuge

Fish Species	Interesting Facts	Regions	Use
Tarpon *Megalops atlanticus*	Prefer warm, shallow water. Can survive at low oxygen levels. Feed at night on small fish crustaceans.	Southeast; Gulf Coast	Nursery
Tautog *Tautoga onitis*	This sport fish has strong jaws and sturdy teeth to eat barnacles and mussels.	Northeast; Southeast	Food; Nursery Refuge; Spawning
Topsmelt *Atherinops affinis*	Common in bays, muddy and rocky areas, and kelp beds. Adults feed on small animals suspended in water.	Pacific; Alaska	Food; Refuge
Weakfish *Cynoscion regalis*	Juveniles live in shallow, grassy areas including seagrasses and salt marshes.	Northeast; Southeast; Gulf Coast	Food; Nursery; Refuge
Winter flounder *Pleuronectes americanus*	Usually spend winters burrowed in the mud and are more active in the spring and fall.	Northeast; Southeast	Food; Nursery; Refuge

Fish Found in Salt Marshes

Fish Species	Interesting Facts	Regions	Use
Alewife *Alosa pseudoharengus*	Adults live in saltwater and migrate to freshwater streams to spawn in wetlands and quiet waters. Eat shrimp and small fish.	Northeast	Nursery
Arrow goby *Clevelandia ios*	Feed mostly on invertebrates or algae. Females lay eggs over vegetation and males fertilize and guard eggs.	Pacific	Nursery
Atlantic croaker *Micropogonias undulatus*	Visit salt marshes when weather is warm to eat small shrimp, crabs, mollusks and worms.	Southeast	Nursery
Atlantic menhaden *Brevoortia tyrannus*	Support a large fishing industry and are used for fish meal and oil.	Northeast; Southeast	Nursery
Atlantic silverside *Menidia menidia*	Eat shrimp, squid, and marine worms. Eaten by striped bass and trout.	Northeast; Southeast	Food; Nursery; Refuge; Spawning
Bay anchovy *Anchoa mitchilli*	More commonly found in shallow tidal wetlands with muddy bottoms with salty to fresh water.	Northeast; Southeast; Gulf Coast	Nursery
Bay scallop *Argopecten irradians*	Attach to salt marsh blades as juveniles before settling on the bottom.	Southeast	Nursery
Blue crab *Callinectes sapidus*	Young crabs and molting adults depend on seagrass beds and coastal marshes for food and refuge from predators.	Southeast; Gulf Coast	Nursery; Refuge
Bluefish *Pomatomus saltatrix*	Feed on smaller fish in eelgrass beds. Bluefish travel in schools and prefer warm water. Popular sport fish.	Northeast	Spawning
Brown shrimp *Penaeus aztecus*	Shrimp production has been linked to amount of wetland and amount of edge between wetland and open water.	Southeast; Gulf Coast	Nursery; Refuge
California mussel *Mytilus californianus*	Should not be eaten if they are in polluted waters because filter feeders concentrate pollutants in their	Northeast; Southeast;	Nursery

Fish Species	Interesting Facts	Regions	Use
Coho salmon *Oncorhynchus kisutch*	Born in freshwater, juveniles spend time in salt marshes to adjust to saltwater before entering the open ocean.	Pacific; Alaska	Nursery; Refuge
Chinook salmon *Oncorhynchus tshawytscha*	Juveniles spend up to six months in salt marshes to feed and adjust to saltwater before entering the ocean.	Pacific; Alaska	Food; Nursery; Refuge
Daggerblade grass shrimp *Palaemonetes pugio*	Are eaten by many marine sport and commercial fish.	Northeast; Southeast; Gulf Coast	Food; Nursery; Refuge
Diamond killifish *Adinia xenica*	Important prey for larger fish that live in salt marshes and mangroves.	Southeast; Gulf Coast	Food; Nursery Refuge
Dungeness crab *Cancer magister*	Larvae hitchhike on jellyfish or ride tidal currents to get from spawning grounds to salt marshes and seagrass beds, where they settle among vegetation to grow to adulthood.	Pacific; Alaska	Nursery
Eastern oyster *Crassostrea virginica*	Filter feeders with two hard shells for protection. Produce pearls when a grain of sand or tiny irritant is lodged in the body because oysters coat the irritant with layers of calcium carbonate.	Southeast	Food; Nursery; Spawning
Leopard shark *Triakis semifasciata*	Eat crabs, shrimp, other fish, and fish eggs. These commercial and sport fish are sold fresh and frozen.	Pacific	Food
Mummichog *Fundulus heteroclitus*	Live in saltwater marshes and tidal creeks. Can breathe air when out of water.	Northeast	Food; Refuge
Northern anchovy *Engraulis mordax*	Eat small crustaceans and fish larvae and in turn are important food source for larger fish and birds. Multi-million dollar commercial fishery developed after the decline of Pacific sardine fishery in the 1940s.	Pacific	Food; Refuge
Pacific herring *Clupea pallasi*	Spawn in salt marsh vegetation. Fertilized eggs attach to marsh grasses, eelgrass, and algae.	Pacific	Nursery; Spawning
Pacific staghorn sculpin *Leptocottus armatus*	Small, smooth, largeheaded fish that are very sensitive to pollution.	Pacific	Nursery
Pink shrimp *Penaeus duorarum*	Shrimp production has been linked to amount of wetland and amount of edge between wetland and open water.	Southeast; Gulf Coast	Nursery; Refuge
Red drum *Sciaenops ocellatus*	Live in marshes during a few months in the summer to take advantage of abundant food and warmth.	Northeast; Southeast	Nursery
Saltmarsh topminnow *Fundulus jenkinsi*	Important prey for larger fish. Loss of salt marsh habitat may lead to future listing as endangered.	Gulf Coast	Food; Nursery; Refuge; Spawning
Sand seatrout *Cynoscion arenarius*	Prefer shallow, grassy areas including seagrasses and salt marshes. Eat grass shrimp and small fish.	Southeast	Nursery; Spawning
Silver perch *Bairdiella chrysoura*	Found in coastal waters over sandy and muddy bottoms. Move to wetland nursery and feeding areas in estuaries during summer.	Northeast; Southeast	Nursery
Silverstripe halfbeak *Hyporhamphus unifasciatus*	Feed on small fish and invertebrates in salt marshes during high tide.	Northeast; Southeast; Pacific	Food
Spot *Leiostomus xanthurus*	Juveniles often stay in the estuarine wetlands throughout the year, eating worms, small crustaceans, and organic detritus.	Northeast; Southeast	Nursery

Fish Species	Interesting Facts	Regions	Use
Spotfin mojarra *Eucinostomus argenteus*	Live in marshes during a few months in the summer to take advantage of abundant food and warmth.	Northeast; Southeast	Nursery
Starry flounder *Platichthys stellatus*	Will change coloration to blend in with the bottom.	Gulf Coast; Pacific	Nursery
Striped bass *Morone saxatilis*	Popular commercial and sport fish that live in coastal waters and bays, but may enter rivers in the spring to spawn.	Northeast; Southeast; Gulf Coast; Pacific	Food; Nursery; Spawning
Striped killifish *Fundulus majali*	Important prey for larger sport fish.	Northeast	Food
Striped mullet *Mugil cephalus*	Live over shallow, muddy bottoms. Scoop mouthfuls of mud and digest tiny plants as the mud passes through the gut.	Southeast	Nursery
Threespine stickleback *Gasterosteus aculeatus*	Inhabit vegetated areas, usually over mud or sand. Eat worms, crustaceans, aquatic insects, drowned aerial insects, and small fish; has also been reported to eat their own young.	Northeast; Southeast; Pacific	Nursery
Topsmelt *Atherinops affinis*	Bottom grazing fish that can withstand high salinity.	Pacific	Nursery
White perch *Morone americana*	Game fish that lives in brackish coastal waters.	Northeast; Southeast	Nursery
White shrimp *Penaeus sertiferus*	Shrimp production has been linked to amount of wetland and amount of edge between wetland and open water.	Southeast; Gulf Coast	Nursery; Refuge
Winter flounder *Pleuronectes americanus*	Also called halibut, flatfish and blackback. Usually spend winters burrowed in the mud.	Northeast; Southeast	Spawning

Fish Found in Mangrove Wetlands

Fish Species	Interesting Facts	Regions	Use
American eel *Anguilla rostrata*	Migrate from freshwater to the saltwater Sargasso Sea to spawn. Juveniles return to grow up in freshwater wetlands.	Southeast	Food; Refuge
Atlantic stingray *Dasyatis sabina*	These small, tropical rays live in shallow coastal waters and eat small crustaceans and invertebrates found in mangroves.	Southeast; Gulf Coast	Food
Common snook *Centropomus undecimalis*	Staying close to shore, these sport fish eat crustaceans and small fish.	Southeast	Nursery
Crabs *Aratus spp., Callinectes spp*	Soil and roots provide detritus for food and habitat. Aratus is able to climb mangrove trees.	Southeast	Food; Refuge
Dwarf herring *Jenkinsia lamprotaenia*	Swims in schools. Important food for many larger fish and squids.	Southeast	Food; Refuge
Dwarf seahorse *Hippocampus zosterae*	Found in mangroves, seagrasses, and floating vegetation.	Southeast	Food; Refuge
Eastern oyster *Crassostrea virginica*	Filter feeders with two hard shells for protection. Oysters attach themselves to the bottom and cannot move.	Southeast	Food; Spawning

Fish Species	Interesting Facts	Regions	Use
Goldspotted killifish *Floridichthys carpio*	Important food for larger fish. Some commercial uses.	Southeast	Food; Refuge
Gray Snapper *Lutjanus griseus*	Commercially and recreationally important fish. Juveniles seek shelter in mangrove swamps and seagrass beds.	Southeast	Food; Nursery
Ladyfish *Elops saurus*	Spawn in the open sea, but juveniles seek refuge and food in mangroves.	Southeast	Nursery
Mangrove rivulus *Rivulus marmoratus*	Live in salt marshes and mangroves, sometimes seek shelter in crab burrows. Can survive at low oxygen levels. May be listed as endangered in the future.	Southeast	Food; Refuge
Mussels *Brachiodontes spp.*	Wetland plants and detritus are food and habitat for these filter feeders.	Southeast	Food; Refuge
Red drum *Siaenops ocellatus*	These commercially and recreationally important bottom feeders eat crabs and shrimp.	Southeast	Food; Nursery
Redear sardine *Harengula humeralis*	Marketed fresh or canned.	Southeast	Food; Refuge
Sailfin molly *Poecilia latipinna*	Live in ponds, lakes, sloughs, coastal waters, and quiet, vegetated backwaters of streams. Eat mostly algae.	Northeast; Southeast	Food; Refuge
Sheepshead *Archosargus probatocephalus*	Flat front teeth protrude beyond the lips making these fish look like sheep. Eat small fish and other animals that eat wetland detritus.	Southeast	Food; Nursery
Shrimp *Penaeus spp.*	Important commercial and recreational fishery, especially in the Gulf Coast. Young shrimp migrate to estuarine wetlands and live on the bottom where they find food and refuge from predators.	Southeast; Gulf Coast	Food; Nursery; Refuge
Silver jenny *Eucinostomus gula*	Prefer shallow waters, especially mangrove-lined lagoons or creeks. Marketed fresh.	Southeast	Refuge
Spotfin mojarra *Eucinostomus argenteus*	Jaws extend to form a short tube used to suck worms and other invertebrates from the bottom.	Southeast	Food; Refuge
Spotted seatrout *Cynoscion nebulosus*	These popular recreational and commercial fish prefer shallow, vegetated areas.	Southeast	Food; Nursery
Striped anchovy *Anchoa hepsetus*	Commonly found in shallow tidal wetlands with muddy bottoms with salty to fresh water.	Southeast; Gulf Coast	Food; Refuge
Tarpon *Megalops atlanticus.*	Prefer warm shallow waters and can survive at low oxygen levels. Feed at night on small fish and crustaceans.	Southeast	Nursery

Fish Found in Tidal Freshwater Marshes

Fish Species	Interesting Facts	Regions	Use
Alligator gar *Lepisosteus spatula*	Use swim bladders to gulp surface air when oxygen in water is low. Can live in drying pools and out of water, if moist, for 24 hours. Spawn in shallows among wetland plants.	Northeast; Southeast	Food; Nursery; Spawning
American eel *Anguilla rostrata*	Migrate from freshwater to the saltwater Sargasso Sea to spawn. Adults die after spawning, and juveniles return to grow up in freshwater wetlands.	Northeast; Southeast	Food; Nursery; Refuge

Fish Species	Interesting Facts	Regions	Use
Atlantic croaker *Micropogonias undulatus*	Frequent shallow water wetlands when weather is warm. Eat small shrimp, crabs, mollusks, and worms.	Northeast; Southeast; Gulf Coast	Nursery
Atlantic menhaden *Brevoortia tyrannus*	Support a large fishing industry and are used for fish meal and oil.	Northeast; Southeast	Nursery
Banded killifish *Fundulus diaphanus*	Bait for sport fishing; food for larger commercial or sport fish and wading birds.	Southeast	Food; Spawning
Bay anchovy *Anchoa mitchilli*	Marshes provide food for juveniles and adults in the spring, refuge for adults in winter, and a nursery in summer.	Northeast; Southeast; Gulf Coast	Food; Nursery; Refuge
Black crappie *Pomoxis nigromaculatus*	Males build nests in shallow marshes.	Southeast; Great Lakes Pacific	Food; Nursery
Black drum *Pogonias cromis*	Juveniles use estuarine wetlands. Eat crustaceans, mollusks, and fish.	Northeast; Southeast	Nursery
Blueback herring *Alosa aestivalis*	Return to the streams where they were hatched to spawn. Juveniles stay in wetland nurseries until the fall, when they move out to sea.	Northeast; Southeast	Nursery
Bluegill *Lepomis macrochirus*	Live in shallow water marshes. Males create nests for eggs and protect eggs until they hatch.	Southeast; Great Lakes	Food; Nursery
Bowfin *Amia calva*	Prefer dense vegetation and clear water within marshes, swamps, and sluggish creeks. Build nests in wetland vegetation.	Northeast; Southeast	Food; Nursery
Brown shrimp *Penaeus aztecus*	Important commercial and recreational fishery, especially in the Gulf Coast. Young shrimp migrate to estuarine wetlands and live on the bottom where they find food and refuge.	Northeast; Southeast; Gulf Coast	Nursery
Chain pickerel *Esox niger*	Hide among aquatic plants and logs and wait for prey to approach. Eggs are scattered in wetland plants.	Northeast; Southeast; Gulf Coast	Food; Nursery; Spawning
Channel catfish *Ictalurus punctatus*	Often served in supermarkets and restaurants. Locate plant seeds, insects, crawfish, fish, and other prey on the bottom through smell and touch.	Great Lakes	Food
Common snook *Centropomus undecimalis*	Staying close to shore, these sport fish eat crustaceans and small fish.	Gulf Coast	Nursery
Eastern mosquitofish *Gambusia holbrooki*	Originally from the southeast United States, these eat mosquitos. Can survive in stagnant waters that mosquitos prefer. Also eat the young of native fish.	Throughout U.S.	Food; Nursery; Refuge; Spawning
Eastern silvery minnow *Hybognathus regius*	Lay eggs over vegetation in quiet backwaters about six inches deep.	Northeast; Southeast	Food; Nursery; Refuge; Spawning
Hogchoker *Trinectes maculatus*	Important food for larger fish.	Northeast; Southeast	Nursery; Refuge
Largemouth bass *Micropterus salmoides*	Popular sport fish. Males create nests and guard eggs. Adults eat other fish, frogs, ducklings, and small mammals.	Southeast; Great Lakes	Food; Nursery
Mummichog *Fundulus heteroclitus*	Bait for sport fishing and food for larger fish and wading birds.	Northeast; Southeast	Food; Spawning

Fish Species	Interesting Facts	Regions	Use
Pacific lamprey *Lampetra tridentata*	Migrate from open ocean to freshwater tidal marshes and pools to spawn. Parasitic adults attach to other fish or whales to draw blood and other fluids for food.	Pacific	Spawning
Pacific salmon *Oncorhynchus spp.*	Juveniles seek refuge in tidal freshwater marshes before travelling to the open ocean as adults.	Pacific; Alaska	Nursery; Refuge
Pink shrimp *Penaeus duorarum*	Important commercial and recreational fishery, especially in the Gulf Coast. Young shrimp migrate to estuarine wetlands and live on the bottom where they find food and refuge.	Northeast: Southeast;	Nursery Gulf Coast
Silver perch *Bairdiella chrysoura*	Use marshes as nursery and feeding areas in estuaries during summer. Eat crustaceans, worms and fish.	Southeast	Nursery
Spot *Leiostomus xanthurus*	Pan-sized drum that are popular with bridge and pier anglers.	Northeast; Southeast; Gulf Coast	Nursery
Spottail shiner *Notropis hudsonius*	Often sold as bait fish, many shiners prefer slow, vegetated waters of ponds, swamps, and marshes.	Northeast: Southeast	Food; Nursery; Refuge; Spawning
Spotted seatrout *Cynoscion nebulosus*	These popular recreational and commercial fish prefer shallow, grassy areas including freshwater marshes.	Southeast	Nursery
Striped bass *Morone saxatilis*	Spend their whole lives in the estuary, but migrate to freshwater to spawn. Recent declines have led to restrictions on commercial and recreational fishing. Was successfully introduced into the western U.S.	Northeast; Southeast; Gulf Coast; Pacific	Food; Nursery
Sturgeon *Acipenser spp.*	Eggs are prized as caviar. Sturgeon are migratory and are among the largest freshwater fish. White sturgeon on the West Coast can be as long as 4 meters.	Northeast; Southeast; Pacific	Nursery; Spawning
Summer flounder *Paralichthys dentatus*	Sold fresh and frozen. Exported fresh to Japan for sashimi.	Northeast; Southeast	Nursery
Tarpon *Megalops atlanticus*	Prefer warm, shallow waters and can survive at low oxygen levels. Feed at night on small fish and crustaceans.	Gulf Coast	Nursery
Warmouth *Lepomis gulosus*	Popular sport fish. Eat other fish, crawfish and insects. Males built nests and guard eggs until they hatch. Prefer thick aquatic vegetation.	Southeast; Great Lakes	Food; Nursery
White shrimp *Penaeus sertiferus*	Important commercial and recreational fishery, especially in the Gulf Coast. Young shrimp migrate to estuarine wetlands and live on the bottom where they find food and refuge.	Northeast; Southeast; Gulf Coast	Nursery

Fish Found in Non-tidal Freshwater Marsh

Fish Species	Interesting Facts	Regions	Use
Black bullhead *Ameiurus melas*	Commercial and game fish that live in ponds, marshes, and backwaters. Eat insects and crustaceans when young. Adults eat clams, snails, plant material and fish.	Great Lakes - Big Rivers	Food

Fish Species	Interesting Facts	Regions	Use
Black crappie *Pomoxis nigromaculatus*	Build nests in shallow wetlands near vegetation. Females can lay up to 188,000 eggs.	Northeast; Southeast; Great Lakes	Food; Nursery
Bluegill *Lepomis macrochirus*	Live in shallow water marshes and fens among wetland plants. Males create nests for eggs and protect eggs until they hatch.	Northeast; Southeast;	Food; Nursery
Brook silverside *Labidesthes sicculus*	Leap to catch food, avoid predators and in spawning rituals. Eggs are fertilized within the female's body, then released onto vegetation.	Great Lakes - Gulf Coast	Spawning
Brook Trout *Salvelinus fontinalis*	Popular sport fish that prefer small streams, ponds, and fens.	Northeast	Food
Brown bullhead *Ameiurus nebulosus*	Found in marshy areas of slow moving creeks, lakes, and ponds. Pairs prepare nests under the cover of vegetation.	Northeast; Southeast; Great Lakes	Food; Nursery; Spawning
Brown Trout *Salmo trutt*	Lives in small creeks, rivers, lakes, and fens.	Northeast;	Food
Channel catfish *Ictalurus punctatus*	Often the catfish found at supermarkets and restaurants. Locates plant seeds, insects, crawfish, fish, and other prey through smell and touch.	Throughout U.S.	Food
Common carp *Cyprinus carpio*	Undesirable nuisance species whose introduction into this country from Asia was an ecological and commercial blunder. While searching for food, carp rip up aquatic vegetation and muddy the water, making conditions less desirable for native fish.	Throughout U.S.	Food; Nursery; Spawning
Herrings Clupeidae	Return to the streams where they were hatched to spawn. Juveniles stay in wetland nurseries until the fall, when they move out to sea.	Northeast; Southeast; Great Lakes	Nursery
Killifish Cyprinodontidae	Found in fens and other wetland habitats, these important bait fish are food for larger fish.	Throughout U.S.	Food; Refuge
Largemouth bass *Micropterus salmoides*	Males create nests and guard eggs. Adults eat other fish, frogs, ducklings, and small mammals.	Northeast; Southeast; Great Lakes	Food; Nursery
Minnows Cyprinidae	Minnows are important food to larger fish. Used by anglers as bait and in laboratory bioassays to test pollution levels.	Great Lakes	Food; Refuge
Muskellunge *Esox masquinongy*	Often found in heavily vegetated areas of lakes and large rivers. Scatter eggs near aquatic vegetation.	Throughout U.S.	Food; Spawning
Northern Pike *Esox lucius*	Spawn in shallow, vegetated areas where they are most vulnerable to being caught.	Throughout U.S.	Food; Spawning
Pumpkinseed *Lepomis gibbosus*	Thrive in farm ponds and within marsh plants along the edges of larger ponds and lakes. Breed in shallow water and eat insects, snails, clams, and small fish.	Great Lakes	Food; Nursery; Spawning
Smallmouth bass *Micropterus dolomieu*	These popular sport fish can be found in fens and other non-tidal freshwater marshes.	Throughout U.S.	Food
Spotted gar *Lepisosteus oculatus*	Rare fish that live in quiet, clear pools, marshes, and backwaters. Eat a variety of fish and crustaceans.	Great Lakes Gulf Coast	Food; Nursery; Spawning
Walleye *Stizostedion vitreum*	Very sensitive to pollution. Visit marshes during cooler parts of the year and at night to feed, but move to deeper water when warm.	Northeast; Great Lakes	Food
White bass *Morone chrysops*	Can be found in shallow and deep portions of lakes. Broadcast eggs in shallow water. Important commercial and sport fish.	Great Lakes Gulf Coast	Food; Spawning

Fish Species	Interesting Facts	Regions	Use
White crappie *Pomoxis annularis*	Prefer aquatic vegetation and woody debris for cover. Eat small fish, insects, and crustaceans.	Great Lakes	Food; Spawning
Yellow bullhead *Ameiurus natalis*	Eat plant matter, crayfish, aquatic insects, mollusks, and fish. Males and females make nests in wetland plants.	Northeast; Southeast; Great Lakes	Food; Nursery; Spawning
Yellow perch *Perca flavescens*	Tolerant of acidic water. Eggs produced in long, sticky strings that stick to marsh plants or settle to the bottom.	Northeast; Southeast; Great Lakes	Food; Spawning

Fish Found in Forested Wetlands

Fish Species	Interesting Facts	Regions	Use
Alewife *Alosa pseudoharengus*	Commercially important fish that migrate up rivers and small streams to spawn in quiet streamside forests and other wetlands.	Northeast; Great Lakes	Spawning
American eel *Anguilla rostrata*	Migrates thousands of miles from freshwater to the deep, saltwater Sargasso Sea to spawn.	Eastern Region	Food
Atlantic needlefish *Strongylura marina*	Eat small fish and take advantage of food sources on forested floodplains.	Northeast; Southeast; Gulf Coast	Food
Black crappie *Pomoxis nigromaculatus*	Build nests near vegetation in pocosins and other wetlands. Males build nests and guard eggs.	Northeast; Southeast; Great Lakes	Nursery; Spawning
Bluegill *Lepomis macrochirus*	Live in shallow water marshes among wetland plants Males create nests for eggs and protect them until they hatch.	Northeast;. Southeast; Great Lakes	Nursery; Spawning
Bowfin *Amia calva*	Males prepare nests among swamp plants, tearing out vegetation and making a trench among roots. Fry attach to vegetation for a week with an adhesive organ on the snout.	Eastern U.S.	Nursery; Spawning
Chain pickerel *Esox niger*	Prefer cover of aquatic plants and debris, especially in stream-side swamps. Lie in wait for prey in vegetation. Spawn over vegetation and are well-adapted to the acidic water of pocosins.	Northeast; Southeast; Gulf Coast	Food; Nursery; Spawning
Channel catfish *Lctalurus punctatus*	Bottom feeders that use long whiskers on their snouts for finding prey and recognizing mates.	Throughout U.S.	Nursery; Spawning
Chinook salmon *Oncorhynchus tshawytscha*	Young salmon grow stronger on abundant food resources in protected floodplain wetlands. Some species seek refuge in backwaters from fast water of winter floods.	Pacific; Alaska	Nursery
Crawfish *Procambarus spp.*	In floodplains of streams, crawfish burrow into the mud to reach subsurface water. They emerge during floods to take advantage of abundant food resources.	Southeast; Gulf Coast	Nursery; Spawning
Darters *Etheostoma spp.*	Live in clear, swift-moving rivers and may use forested river-side wetlands for spawning and nursery areas.	Northeast; Southeast; Gulf Coast	Nursery; Spawning
Eastern mosquitofish *Gambusia holbrooki*	Introduced throughout the country to eat mosquitos. Survives in stagnant waters that mosquitos prefer.	Throughout U.S.	Nursery; Spawning

Fish Species	Interesting Facts	Regions	Use
Eastern mudminnow *Umbra pygmaea*	Live in quiet streams, sloughs, swamps, and other wetlands. Found most often among dense vegetation. Eat insect larvae and worms.	Northeast; Southeast	Food; Nursery; Refuge
Flier *Centrarchus macropterus*	Prefer warm waters with plants, such as swamps and pocosins. Males build nests and guard the eggs. Eat insects and crustaceans.	Southeast; Gulf Coast	Nursery; Spawning
Freshwater drum *Aplodinotus grunniens*	These sport fish feed on insects, crayfish and fish. Feed in wetlands at night. Males make drumming sounds during reproduction.	Great Lakes Gulf Coast	Nursery; Spawning
Gars *Lepisosteus spp.*	Air bladder can be used to breathe oxygen from the air. This allows gars to take advantage of food and protection from predators in stagnant backwaters with low oxygen levels.	Southeast; Gulf Coast	Nursery; Spawning
Gizzard shad *Dorosoma cepedianum*	Young shad are important food for game fish, but as they grow they compete with these fish for space, and can become a nuisance.	Northeast; Southeast	Nursery; Spawning
Hickory shad *Alosa mediocris*	Adults return to the streams where they were hatched to spawn. Juveniles stay in wetland nurseries until the fall, when they move out to sea.	Southeast; Great Lakes	Nursery; Spawning
Killifish *Fundulidae*	Important bait fish and food for larger fish, killifish can withstand wide fluctuations in temperature and oxygen. Also are useful for mosquito control.	Southeast; Gulf Coast	Food; Nursery; Refuge; Spawning
Lake chubsucker *Erimyzon sucetta*	Spawn over vegetation. Young travel in schools with juvenile largemouth bass and other fish.	Southeast	Food; Spawning
Largemouth bass *Micropterus salmoides*	Popular sport fish. Males create nests and guard eggs. Adults eat other fish, frogs, ducklings and small mammals.	Throughout U.S.	Nursery; Spawning
Paddlefish *Polyodon spathula*	Strain small organisms out of the water. Commercially important, particularly the eggs which are used for caviar.	Great Lakes Gulf Coast	Nursery
Pirate perch *Aphredoderus sayanus*	Prefers swamps, backwaters, creeks, and other areas with slow water, soft bottoms, and aquatic vegetation. Hide in vegetation during the day and emerge at night to feed on insects and crustaceans. Can survive low oxygen.	Southeast; Gulf Coast; Great Lakes	Food; Nursery; Refuge; Spawning
Redfin pickerel *Esox americanus americanus*	Prefer backwater ponds, pocosins, and flooded swamps. Eats small fish, frogs and invertebrates. Use wetland vegetation to lie in wait for prey and to lay eggs.	Southeast	Food; Nursery; Spawning
Shovelnose sturgeon *Scaphirhynchus platorynchus*	Live in bottom of stream channels and in pools and backwater wetlands of large, slow-moving rivers. Are endangered.	Great Lakes; Southwest	Food; Nursery
Suckers *Catostomidae*	Suckers are specialized to suck and scrape algae, invertebrates, and detritus from the bottom.	Gulf Coast	Nursery; Spawning
Warmouth *Lepmois gulosus*	Popular sport fish. Males built nests and guard eggs until they hatch. Prefer thick aquatic vegetation in slow streams, ponds, lakes and pocosins.	Southeast; Gulf Coast	Nursery; Spawning
White bass *Morone chrysops*	Spawn by broadcasting eggs in shallow water that settle on the bottom. Important commercial and	Great Lakes; Gulf Coast	Nursery; Spawning
Yellow bass *Morone mississippiensis*	Game fish that live in ponds, lakes and backwaters of small to large rivers.	Great Lakes; Southeast; Southwest	Nursery; Spawning

Fish Species	Interesting Facts	Regions	Use
Yellow bullhead *Ameiruss natalis*	Eat plant matter, crayfish, aquatic insects, mullusks, and fish. Make nest among plants, logs or roots.	Southeast; Gulf Coast	Nursery; Spawning
Yellow perch *Perca flavescens*	Tolerant of acidic waters and found in pocosins. Lay eggs in aquatic vegetation and eat small fish, inscets, crayfish and other inverebrates living in forested wetlands.	Southeast	Food; Nursery; Refuge; Spawning