

Amphibians

American bullfrog

General information

American Bullfrogs are relatively large frogs that inhabit permanent bodies of standing or slow-moving water. The American bullfrog's native range extends from the Atlantic Coast to eastern Colorado and eastern Mexico, and from southern Colorado to northeastern Mexico. Bullfrogs are not native west of the Rocky Mountains, but have been successfully introduced in many areas. Bullfrog tadpoles require two years to metamorphose. They prefer shorelines with dense vegetation adjacent to shallow open water dominated by floating and submerged aquatic vegetation. All habitat requirements are usually found in and around a single pond.



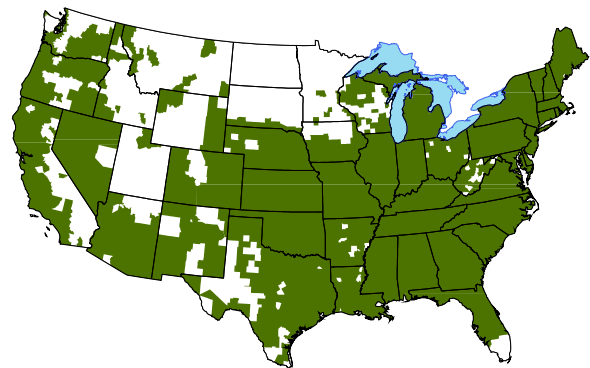
Bill Buchanan

Habitat requirements

Diet: insects, crayfish, other frogs, reptiles, snails, fish, and occasionally small mammals and birds

Water: stable water levels are necessary for hibernation and egg development; water levels should be maintained at a constant level

Cover: dense, emergent aquatic and upland herbaceous vegetation adjacent to water for hiding and foraging



Wildlife management practices

Livestock Management: livestock should be excluded from ponds managed for bullfrog; livestock watering facilities should be developed away from pond

Repair Spillway/Levee: if not functioning properly

Water Control Structures: should be installed if none are present in existing dams and levees so water depth can be managed as appropriate

Water Developments for Wildlife: ponds and shallow impoundments can be provided where habitat for bullfrogs is absent or insufficient for desired population

Decrease Harvest: if current hunting pressure is causing population to decline and population growth is desired

Increase Harvest: where populations can sustain additional harvest pressure for hunting recreation

Wildlife or Fish Survey: call counts are used to estimate population trends

Crawfish frog

General information

Crawfish frogs occur from Indiana south to Louisiana, and from eastern Kansas south to the Texas coast. Crawfish frogs are found in a variety of vegetation types ranging from damp wooded valleys, open brushy fields, to tallgrass prairies. Populations are often associated with major river floodplains. Areas with shallow soils and intensive agriculture are avoided. Crawfish frogs are largely fossorial and spend the non-breeding season in crayfish burrows. Adults make annual migrations to temporary, fishless ponds to breed. Eggs hatch within 3-4 days, but tadpoles may take 2 months to transform.



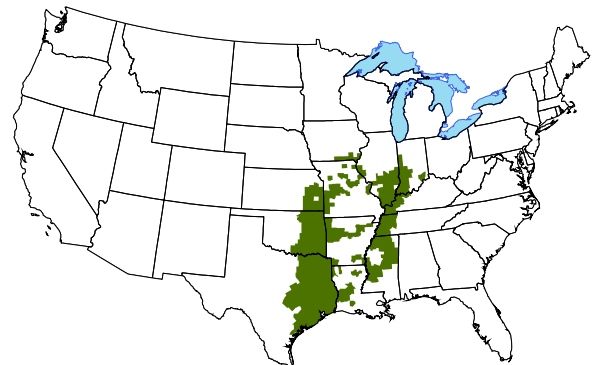
Rick Fridell

Habitat requirements

Diet: adults eat beetles, spiders, crickets, ants, millipedes, and small crayfish; tadpoles filter feed on phytoplankton

Water: breed in ephemeral, fishless ponds with grassy margins

Cover: adults require low, wet areas, including moist meadows, prairies, woodlands, and brushy fields; burrows are required; crayfish burrows are preferred, but any burrow may be used as long as it reaches the water table; tadpoles require ponds that contain some algae, pondweed, and other vegetation to provide food and shelter



Wildlife management practices

Conservation Easement: can protect critical habitat for this declining species

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for crawfish frogs

Livestock Management: livestock should be excluded from ponds that may be used as breeding ponds for crawfish frogs; livestock watering facilities should be developed away from pond

Plant Native Grasses and Forbs: may be necessary to convert fields currently in row-crop agriculture to crawfish frog habitat

Plant Shrubs: in fields that are currently in row-crop agriculture to convert them to crawfish frog habitat, or in large open areas that need additional cover

Water Control Structures: should be installed if not present in ponds with levees that are managed for crawfish frogs to enable the pond to be drained, especially if fish are present

Water Developments for Wildlife: small, fishless ponds and impoundments may be created if additional breeding ponds are needed

Wildlife or Fish Survey: call counts are used to estimate population trends

Monterey salamander

General information

The Monterey salamander occurs along the Pacific coast from Washington to southern California. This species is treated as a “ring” species whose subspecies form a ring-shaped distribution around the Central Valley of California and do not interbreed where the ends of the ring overlap in southern California. It inhabits a wide variety of vegetation types in hilly or mountainous terrain from near sea level to approximately 10,000 feet in elevation. Monterey salamanders occur in chaparral, wet coastal forests, coastal sagebrush, pine-oak woodlands, and mixed conifer-hardwood forests. Moist soil conditions are necessary for Monterey salamanders to occur because they lack lungs and respire through their moist skin.

Habitat requirements

Diet: invertebrates, such as sow bugs, mites, spiders, centipedes, and beetles

Water: moist soil required for respiration

Cover: large amounts of downed woody debris; they also hide beneath moss mats, rocks, leaf litter, and within rodent burrows

Wildlife management practices

Forest Management: *Forest Regeneration (Group Selection, Single-tree Selection) or Forest Stand Improvement* may be beneficial in areas where additional down woody debris is needed; when regenerating a forest, it is important to use either *Group Selection* or *Single-tree Selection* to minimize area exposed to sunlight and soil-drying conditions

Plant Shrubs: where cover is limiting

Plant Trees: where cover is limiting

Wildlife or Fish Survey: drift fences with pitfall traps are used to estimate population trends



Stuart Wilson



Northern red-legged frog

General information

Northern red-legged frogs are found in low, moist forests of the Pacific Northwest. They typically occur near permanent, quiet water, such as stream pools, marshes, and ponds. During wet weather, they can be found in damp woods and meadows, as well as ephemeral pools. They are active mostly at night, especially during wet periods. Northern red-legged frogs usually remain motionless when approached before bounding away with long, evasive jumps. The breeding call is relatively weak and consists of 4-7 notes that sound like “uh-uh-uh-uh.” When captured by a predator, they often emit a loud scream.

Habitat requirements

Diet: tadpoles are herbivores, consuming algae and organic debris; adults consume small invertebrates, including beetles, caterpillars, and isopods

Water: non-flowing water is required for reproduction

Cover: breeding ponds must not contain fish, and limbs or stems must be present at the surface to attach egg masses; adults use damp woods and meadows with permanent water; fallen logs and other coarse woody debris must be present

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for northern red-legged frogs

Forest Management: Forest Regeneration (Group Selection and Single-tree Selection) can create small canopy gaps in the forest and increase the amount of coarse woody debris; Forest Stand Improvement can also increase understory structure and coarse woody debris; it is important to retain considerable overstory cover

Livestock Management: livestock should be excluded from forests where northern red-legged frogs are a focal species; livestock should be excluded from ponds that may be used as breeding ponds for northern red-legged frogs; livestock watering facilities should be developed away from pond

Plant Trees: where forest cover is limiting

Water Developments for Wildlife: small ponds and impoundments can be created in forested areas to provide breeding areas; woody debris in the pond should include small stems at the water surface for egg mass attachment.

Wildlife or Fish Survey: call counts are used to estimate population trends



Nirvan Hope



Rough-skinned newt

General information

Adult rough-skinned newts prefer moist coniferous and hardwood forests, but also are found in open valleys. Newts require permanent water, such as ponds or slow-moving streams, for courtship, breeding, egg-laying, and larvae development. Eggs are laid singly on aquatic vegetation or submerged twigs. Aquatic larvae transform in late summer, or they over-winter and transform the following summer. Adult rough-skinned newts are generally terrestrial, often seen crawling over land in the daytime and becoming aquatic when breeding. However, some populations hide in daylight and are active at night. Some adults are primarily aquatic. Newts often are seen moving in large numbers to breeding sites during the breeding season. Some newts spend the dry summer in moist areas under woody debris, rocks, or animal burrows. Adults emerge to feed after fall rains. In some populations, adults remain in ponds throughout summer and migrate back onto land in fall following rain events. Often, they will form large aggregates of thousands of newts in the water. Adult newts have rough or granular skin, which produces toxins that repel most predators. Rough-skinned newts may assume a swaybacked defense pose with a coiled tail, exposing the bright ventral surface to warn potential predators. Toxin-resistant garter snakes are the only known animals that prey on rough-skinned newts.

Habitat requirements

Diet: larvae feed on aquatic invertebrates; adults eat amphibian eggs and larvae, aquatic and terrestrial invertebrates, worms, and slugs

Water: permanent water, such as ponds and slow-moving streams, are required for breeding and larval development

Cover: shallow water with aquatic vegetation or submerged woody debris is needed for attachment of eggs; soft logs, rocks, and bark are necessary for adult escape cover

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for rough-skinned newts

Livestock Management: livestock should be excluded from forests where rough-skinned newt is a focal species and from ponds that may be used as breeding ponds for rough-skinned newts; livestock watering facilities should be developed away from pond



Repair Spillway/Levee: if not functioning properly

Water Control Structures: should be installed in pond dams or impoundment levees if none are present so water depth can be controlled

Water Developments for Wildlife: small ponds and impoundments can be constructed when breeding ponds are limiting

Wildlife or Fish Survey: seine surveys and minnow traps could be used to estimate population trends

Tiger salamander

General information

The tiger salamander is a wide-ranging species occurring throughout the Great Plains and much of the eastern U.S. (it is absent from the Appalachian mountain regions). It is one of the largest terrestrial salamanders in North America with adults attaining more than one foot in length. Adults inhabit a wide array of vegetation types including bottomland deciduous forests, conifer forests, woodlands, fallow fields, grasslands, meadows, brushy areas, semideserts, and deserts. Free-standing water must be present for breeding. Adults are terrestrial, but make annual, spring migrations to ephemeral (temporary) ponds to breed. Ephemeral ponds contain water during only a portion of the year. The breeding season is short and eggs develop rapidly. Larvae are top predators in fishless ponds. They often grow quickly and can reach 4-6 inches in length before transforming in late summer.

Habitat requirements

Diet: adults eat worms, snails, insects, and slugs; larvae eat a wide variety of aquatic organisms, including invertebrates and other amphibian eggs and larvae

Water: ephemeral or semi-permanent ponds are necessary for reproduction; ponds should be fishless if successful reproduction is to occur

Cover: adult tiger salamanders live underground in burrows for most of the year; deep leaf litter and large amounts of downed woody debris are most desirable

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for tiger salamanders

Livestock Management: should prevent overgrazing where tiger salamander is a focal species; livestock should be excluded from ponds that may be used as breeding ponds for tiger salamanders; livestock watering facilities should be developed away from pond

Plant Native Grasses and Forbs: when converting fields that are currently in row-crop agriculture to tiger salamander habitat

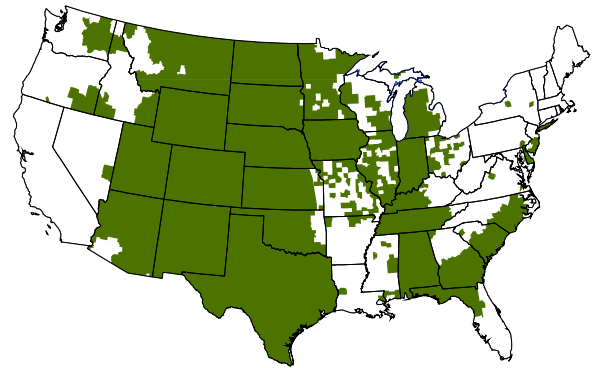
Plant Shrubs: when converting fields that are currently in row-crop agriculture to tiger salamander habitat, or in relatively large open areas that need additional cover

Plant Trees: where additional forest cover is needed

Water Control Structures: should be installed if not present in ponds or impoundments with levees that are managed for tiger salamanders to enable the pond to be drained, especially if fish are present



Gary M. Stoiz



Water Developments for Wildlife: small, fishless ponds or impoundments may be created if additional breeding ponds are needed

Wildlife or Fish Survey: cover boards and pitfall traps along drift fences are used to estimate population trends

Wood frog

General information

Wood frogs have the most extensive range of any North American frog or toad. They occur from the southern Appalachian mountains of Georgia to northern Canada, and westward throughout the Great Lakes region, Canada, and Alaska (not shown on map below). In the northern climates, wood frogs bury themselves in the leaf litter to escape freezing temperatures. They also are able to withstand extended periods of sub-freezing temperatures by increasing blood-glucose levels, which serve as cryoprotectants (antifreeze). Individuals can survive whole-body freezing for more than a week. Wood frogs are closely associated with closed-canopy deciduous and boreal forests. Adults are largely terrestrial, but make annual migrations to ephemeral ponds to breed. The breeding seasons are short (6-14 days) and eggs develop rapidly (4-30 days) in the shallow ponds. Tadpoles grow quickly and generally transform in 6 to 15 weeks.

Habitat requirements

Diet: adults eat terrestrial invertebrates, such as beetles, crickets, spiders, and earthworms; tadpoles filter phytoplankton from the water

Water: breed in shallow water within closed-canopy forests; breeding ponds are usually fishless and are dry at some time of the year

Cover: optimum habitat consists of >70 percent canopy cover in deciduous or boreal forests; prefer areas with moist soils, abundant leaf litter, and downed woody debris

Wildlife management practices

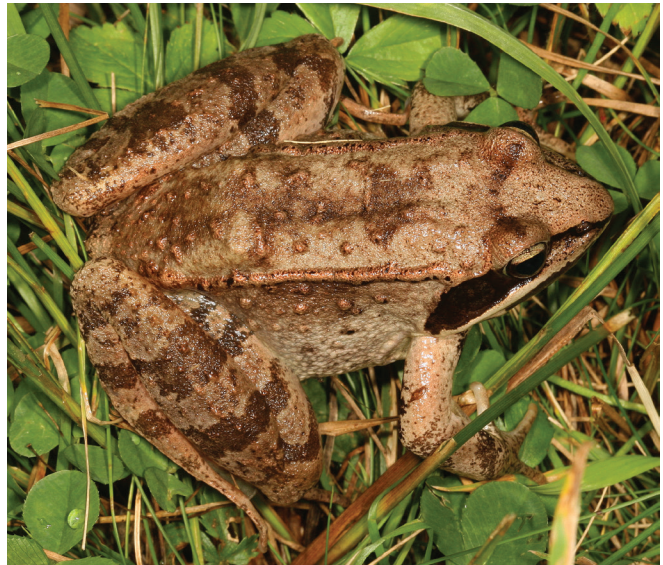
Control Nonnative Invasive Vegetation: where nonnative invasive vegetation creates undesirable conditions for wood frogs, limiting movement to breeding ponds

Livestock Management: livestock should be excluded from forests and from ponds that may be used as breeding ponds for wood frogs; livestock watering facilities should be developed away from pond

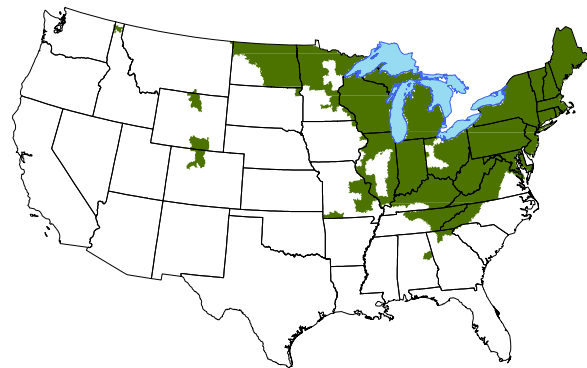
Plant Trees: in large open areas where additional forest cover is needed (should maintain >70 percent canopy cover)

Water Developments for Wildlife: maintain ephemeral pools; create small, fishless ponds or impoundments if additional breeding sites are needed

Wildlife or Fish Survey: call counts are used to estimate population trends



Bo Zarembo



Fish

Bluegill

General information

The bluegill is one of the most abundant Sunfish species. It thrives in a variety of conditions, ranging from freshwater lakes, ponds, and slow moving streams, to brackish waters of coastal areas. The bluegill's native range is the eastern U.S. from southern Canada to Florida and Texas, but they have been successfully introduced throughout the U.S.

Habitat requirements

Diet: a variety of zooplankton (microscopic animal life) during the first few months of life, progressing to insects and their larvae, eggs, earthworms, tadpoles, small minnows, and crayfish

Water: basic requirements include dissolved oxygen (minimum of 4 parts per million); pH between 6.5 and 9.0; and water temperature should reach at least 70 F during summer (one foot below surface in the shade)

Cover: aquatic environments with submerged rocks, woody debris, and aquatic vegetation where small fish (prey) hide

Wildlife management practices

Livestock Management: livestock should either be excluded from fish ponds or only allowed access to a small part of the fish pond; livestock watering facilities should be developed away from the fish pond

Repair Spillway/Levee: if not functioning properly

Water Control Structures: should be installed if none are present so water depth can be controlled

Decrease Harvest: refer to **Wildlife Management Practices** on page 240 for specifics on fish harvest

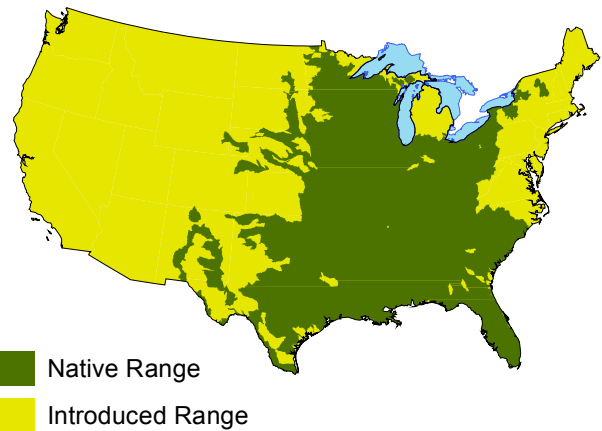
Increase Harvest: refer to **Wildlife Management Practices** on page 241 for specifics on fish harvest

Wildlife or Fish Survey: fishing records, seining, and electro-shocking are used to survey bluegill populations

Construct Fish Pond: where no suitable water source is present or where an existing fish pond needs extensive repair, especially to the dike or dam

Control Aquatic Vegetation: when necessary to discourage undesirable aquatic vegetation

Fertilize/Lime Fish Pond: fertilize to promote phytoplankton growth when visibility is more than 18 inches below the water surface; add agricultural limestone to increase soil pH if total alkalinity is below 20 ppm



Reduce Turbidity in Fish Pond: by reseeding watershed if soil is eroding into the pond and causing muddy water, by preventing livestock from entering pond, by eliminating bottom-feeding fish, or by reducing suspension of negatively charged clay particles

Restock Fish Pond: if the population is too far out of balance to correct via seining or fishing or if undesirable species are present

Channel catfish

General information

Channel catfish are warmwater fish native to the Gulf coast states and the Mississippi River valley, but they have been introduced to most regions of the United States. They have smooth skin (no scales), a deeply forked tail, and sharp dorsal (top) and pectoral (side) fins that can inflict a nasty cut if the fish is handled improperly. They also have barbels (often called “whiskers”) around the mouth. Coloration depends largely on water clarity—they are drab green to blue on the back, shading to white on the belly, but they can appear almost black in clear waters, and yellowish in muddy waters. Young channel catfish have irregular spots on their sides that disappear as they mature. Channel catfish average 2 – 3 pounds, but may grow to 50 pounds. In the presence of largemouth bass and bluegill, predation is heavy upon the catfish eggs and young (called fry). In small impoundments managed for multiple fish species, stocking fingerling channel catfish is the best way to maintain a population. Channel catfish is the most widely cultured (farmed) warmwater fish species in the United States. Each year, several hundred million pounds are raised and harvested as food in grocery stores and restaurants. It is also widely sought by anglers on public and private waters for its recreational value as well as its fantastic flavor.

Habitat requirements

Diet: young catfish feed mostly on aquatic insects; adults eat crawfish, aquatic insects, plant material including algae, snails, small fish, and even seeds; commercially prepared rations have been formulated and are used to feed channel catfish in aquaculture (fish farming) operations as well as in farm ponds and other impoundments

Water: obtained from their aquatic environment and food; reservoirs, lakes and ponds; moderately to swift-flowing streams and rivers with gravel, sand, or muddy bottoms; seldom inhabits water with abundant submerged aquatic vegetation

Cover: females typically lay eggs in dark holes or under logs or rocks

Wildlife management practices

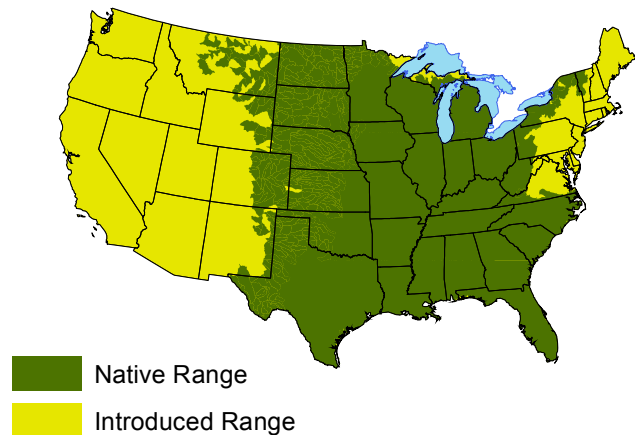
Livestock Management: livestock should either be excluded from fish ponds or only allowed access to a small part of the fish pond; livestock watering facilities should be developed away from the fish pond

Repair Spillway/Levee: if not functioning properly

Water Control Structures: should be installed if none are present so water depth can be controlled



Texas Parks and Wildlife



Decrease Harvest: refer to **Wildlife Management Practices** on page 240 for specifics on fish harvest

Increase Harvest: refer to **Wildlife Management Practices** on page 241 for specifics on fish harvest

Wildlife or Fish Survey: fishing records, seining, and electro-shocking are used to survey channel catfish populations

Construct Fish Pond: where no suitable water source is present or where an existing fish pond needs extensive repair, especially to the dike or dam

Control Aquatic Vegetation: when necessary to discourage undesirable aquatic vegetation

Fertilize/Lime Fish Pond: fertilize to promote phytoplankton growth when visibility is more than 18 inches below the water surface; add agricultural limestone to increase soil pH if total alkalinity is below 20 ppm

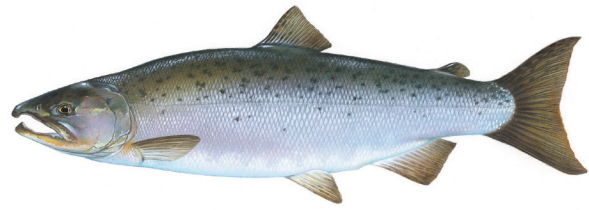
Reduce Turbidity in Fish Pond: by reseeding watershed if soil is eroding into the pond and causing muddy water, by preventing livestock from entering pond, by eliminating bottom-feeding fish, or by reducing suspension of negatively charged clay particles

Restock Fish Pond: if too few are present; channel catfish seldom spawn successfully in the presence of large mouth bass and bluegill because of predation upon eggs and fry--therefore periodic restocking is required when channel catfish numbers drop below desired levels

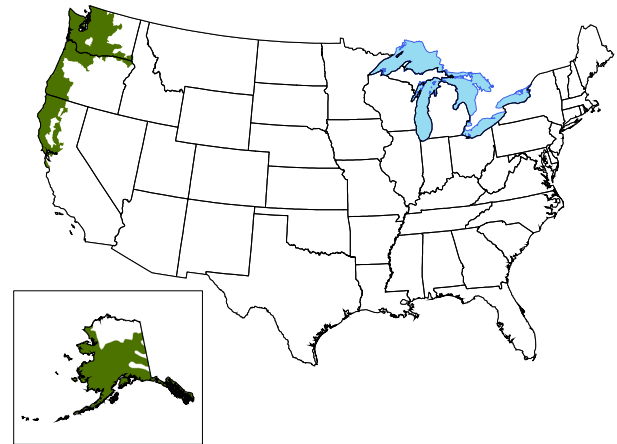
Coho salmon

General information

The Coho salmon is an anadromous fish species, which means they live part of their lives in saltwater before migrating to freshwater to spawn. They can attain weights of about 35 pounds, but 10 pounds is the average. The range of the Coho salmon in the U.S. is from Alaska southward to northern California. While in the ocean, Coho salmon have dark bluish backs and silver sides and are therefore often called silver salmon. When mature (3 years old), Coho salmon migrate to freshwater to spawn (November to January) and their coloration darkens with reddish sides. Males develop a pronounced hooked jaw/nose during the spawning season. Adults return to their stream of origin to spawn and die after spawning. The eggs are laid in nests called redds and hatch 6 to 7 weeks later in the spring. Young Coho salmon remain in streams and freshwater tributaries for more than a year before migrating (they are called smolts in this life stage) to the ocean. The life cycle is complete when they return to their freshwater stream of origin to spawn. The Coho, like many other salmon species found on the west coast, have experienced severe population declines in the past several decades. Reasons for these declines are complex, but include siltation of spawning areas, blockage of migratory routes by dams, and inadequate water flows in spawning areas as a result of water diversion for other purposes. Estuarine and marine ecosystems are often negatively impacted by shoreline development, residential drainage, and filling marine wetlands. Several Coho salmon populations occurring from California to Oregon have been listed as federally endangered or as species of concern. However, this species is an important recreational and commercial fish where populations remain strong, especially in Alaska.



Timothy Knepp



Habitat requirements

Diet: in the freshwater juvenile or fingerling stage, Coho salmon feed on plankton, insects, and small fish; smolts switch to a diet comprised solely of fish upon entering the ocean

Water: obtained from aquatic environment and food

Cover: Coho salmon need pollution-free freshwater and marine ecosystems; spawning streams must have a stable gravel substrate for construction of redds

Wildlife management practices

Wildlife or Fish Survey: fishing records, seining, electro-shocking, and fish condition are used to survey Coho salmon populations

Streams—Remove Fish Barriers: such as culverts or dams that may prevent Coho salmon from migrating upstream to spawn

Cutthroat trout

General information

Cutthroat trout are native to the western U.S. They are found in diverse areas, such as the Rocky Mountains, the valleys of the Great Basin, and inshore areas of the Pacific Ocean, especially along the Washington coastline. They prefer rivers and streams with a gravel bottom, but several subspecies mate in lakes and ponds. Cutthroat trout are carnivores, eating a variety of organisms found in streams and lakes.

Habitat requirements

Diet: young cutthroat trout eat algae and small crustaceans; adults eat crustaceans, eggs, aquatic insects, mollusks, amphibians (tadpoles), and other fish; adults also eat terrestrial organisms if they fall into stream, but they are not a major part of their diet

Water: streams, lakes, and ponds where water does not rise above 70 F in summer; ideally streams should have a variety of riffles, runs, and pools; basic requirements include dissolved oxygen (minimum 6 parts per million); pH range between 6.5 and 9.0

Cover: prefer streams with overhanging vegetation along the shore that provides shade and reduces water temperature, providing terrestrial organisms for food; rocks, as well as debris on the bottom of the river or lake, provide cover that will hide them from prey

Wildlife management practices

Livestock Management: livestock should be excluded from areas managed for cutthroat trout or only allowed access to a small portion; fencing along the riparian area or lakeside may be necessary; livestock watering facilities should be developed away from streams, rivers, lakes, or ponds;

Decrease Harvest: refer to **Wildlife Management Practices** on page 240 for specifics on fish harvest

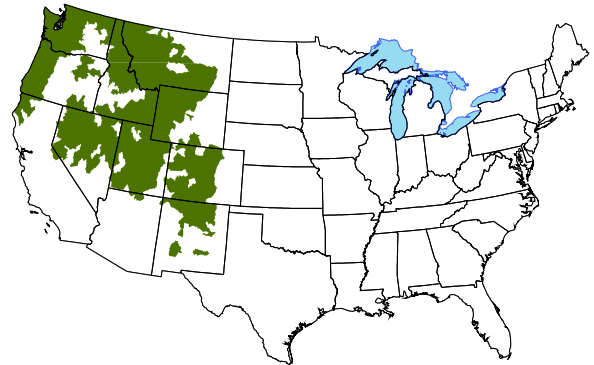
Increase Harvest: refer to **Wildlife Management Practices** on page 241 for specifics on fish harvest

Wildlife or Fish Survey: fishing records, seining, electro-shocking, and fish condition are used to survey cutthroat trout populations

Streams—Create Pools: gravel and cobble should be placed in streams to provide structure for insects and locations for spawning; structures should not change currents, which could increase bank erosion; boulders and logs may be placed in the stream or lake to provide cover for trout while hunting, as well as cover for prey species; this practice is not likely needed if there are overhanging stream banks that provide cover



NPS



Streams—Remove Fish Barriers: because most cutthroat trout populations are migratory, dams can impede their ability to return to spawning grounds; installing fish ladders or removing dams will improve the ability of cutthroat trout to migrate

Largemouth bass

General information

Largemouth bass are not really bass but members of the Sunfish family. Largemouth bass are the most popular freshwater sportfish in states where they are found. They can be found in freshwater lakes, rivers, large streams, farm ponds, and brackish marshes. Their native range includes most of the eastern U.S., but largemouth bass have been stocked all over the country successfully.

Habitat requirements

Diet: young bass eat insects and other invertebrates (worms, crayfish, and zooplankton); adults eat small fish, such as bluegill, and a variety of minnows, as well as tadpoles, crayfish, and even ducklings

Cover: aquatic environments with submerged rocks, woody debris, and aquatic vegetation where small fish (prey) hide

Water: basic requirements include dissolved oxygen (minimum of 4 parts per million); pH should range between 6.5 and 9.0; water temperature should reach at least 70 F during summer (one foot below surface in shade)

Wildlife management practices

Livestock Management: livestock should either be excluded from fish ponds or only allowed access to a small part of the fish pond; livestock watering facilities should be developed away from the fish pond

Repair Spillway/Levee: if not functioning properly

Water Control Structures: should be installed if none are present so water depth can be controlled

Decrease Harvest: refer to **Wildlife Management Practices** on page 240 for specifics on fish harvest

Increase Harvest: refer to **Wildlife Management Practices** on page 241 for specifics on fish harvest

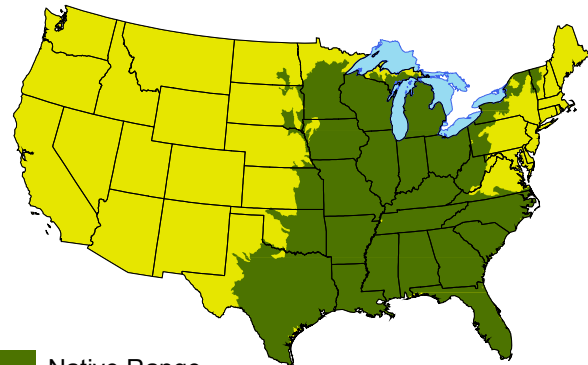
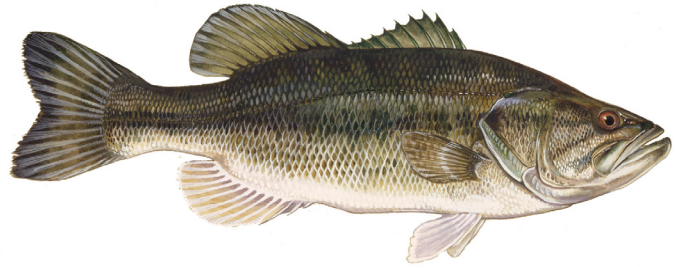
Wildlife or Fish Survey: fishing records, seining, and electro-shocking are used to survey largemouth bass populations

Construct Fish Pond: where no suitable water source is present or where an existing fish pond needs extensive repair, especially to the dike or dam

Control Aquatic Vegetation: when necessary to discourage undesirable aquatic vegetation

Fertilize/Lime Fish Pond: fertilize to promote phytoplankton growth when visibility is more than 18 inches below the water surface; add agricultural limestone to increase soil pH if total alkalinity is below 20 ppm

Reduce Turbidity in Fish Pond: by reseeding watershed if soil is eroding into the pond and causing muddy water, by preventing livestock from entering pond, by eliminating bottom-feeding fish, or by reducing suspension of negatively charged clay particles



■ Native Range
■ Introduced Range

Restock Fish Pond: if the population is too far out of balance to correct via seining or fishing or if undesirable species are present

Rainbow trout

General information

Rainbow trout are native to the U.S. west of the Rocky Mountains. However, they have been introduced throughout the U.S. as a sport fish. Rainbow trout are cool- to cold-water fish that do best in freshwater systems below 70 F. They can thrive in both rivers and lakes. Rainbow trout are carnivorous and spawn in areas with a rocky bottom. A water flow that reduces sedimentation of the river floor will increase spawning. A healthy riparian system supports trees and shrubs that prevent erosion and sedimentation and shade the water along the sides of the stream or river. Rainbow trout have driven many native species into extinction or endangerment in places where they have been introduced. Thus, increased harvest may be required in some streams to control their abundance in river systems and protect native species.

Habitat requirements

Diet: fish, aquatic insects, crustaceans, and mollusks; also eat terrestrial organisms that fall into the water

Water: streams, lakes, and ponds where the water does not get above 70 F in summer; ideally, stream should have 50 percent riffles and 50 percent pools; basic requirements include dissolved oxygen (minimum of 6 parts per million); pH should range between 6.5 and 9.0

Cover: rocks, as well as debris on the bottom of the river or lake, provide cover for hiding from prey or fishermen

Wildlife management practices

Livestock Management: livestock should either be excluded from fish ponds or only allowed access to a small part of the fish pond; livestock watering facilities should be developed away from the fish pond

Repair Spillway/Levee: if not functioning properly

Water Control Structures: should be installed if none are present so water depth can be controlled

Decrease Harvest: refer to **Wildlife Management Practices** on page 240 for specifics on fish harvest

Increase Harvest: refer to **Wildlife Management Practices** on page 242 for specifics on fish harvest;

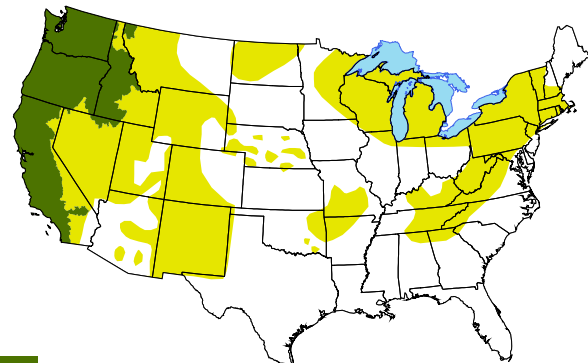
managers have begun reducing rainbow trout populations to minimize predation on or competition for resources with native fish species; increasing harvest can reduce the rainbow trout population

Wildlife or Fish Survey: fishing records, seining, electro-shocking, and fish condition are used to survey rainbow trout populations

Construct Fish Pond: where no suitable water source is present or where an existing fish pond needs extensive repair, especially to the dike or dam



Robert A. Pos



Control Aquatic Vegetation: when necessary to reduce undesirable aquatic vegetation

Fertilize/Lime Fish Pond: fertilize to promote phytoplankton growth when visibility is more than 18 inches below the water surface; add agricultural limestone to increase soil pH if total alkalinity is below 20 ppm

Reduce Turbidity in Fish Pond: by reseeding watershed if soil is eroding into the pond and causing muddy water, by preventing livestock from entering pond, by eliminating bottom-feeding fish, or by reducing suspension of negatively charged clay particles

Restock Fish Pond: if too few are present

Streams—Create Pools: gravel and cobble can be placed in stream to provide structure for insects and locations for spawning; structures should not change currents, which could increase bank erosion; boulders and logs may be placed in the stream or lake to provide cover for trout while hunting, as well as cover for prey species

Streams—Remove Fish Barriers: because most native rainbow trout populations are migratory, dams can impede their ability to return to spawning grounds; installing fish ladders or removing dams will improve the ability of rainbow trout to migrate

Invertebrates

American bumble bee

General information

The American bumble bee is a long-tongued bee native to most of North America. Queens range from 2.1 to 2.5 centimeters, workers are 1.4 to 1.8 centimeters, and males are 1.6 to 2.2 cm. Eyes are set high on the face and body hair is short and even. Queens and workers have a black face and head and a yellow-to-black thorax and abdomen. Wings have a distinct black band. A colony is comprised of a queen, workers, males, and new queens (50-150 individuals). A fertilized queen from the previous season overwinters in deadwood or underground. She selects a nest site on or under the ground and constructs a nest lined with plant material. The queen collects nectar and pollen to feed her first brood, which consists of all workers (females). The workers then take over foraging duties while the queen remains at the nest. Both males and queens are produced later in the season. Young queens leave the nest site and mate with males in the fall. Only fertilized queens overwinter. The American bumble bee is an important pollinator that occurs in early successional vegetation, such as grasslands, savannas, and farm fields. Optimum habitat conditions provide a variety of flowering plants during all periods of the growing season.

Habitat requirements

Diet: nectar and pollen from a variety of flowering plants

Water: require free-standing water and use it at the hive to regulate the temperature of the hive, feed young bees, and dilute stored honey

Cover: undisturbed early successional ecosystems rich in flowering plants

Wildlife management practices

Conservation Easement: to protect relatively large, contiguous areas of early successional plant communities

Control Nonnative Invasive Vegetation: when nonnative vegetation begins to compete with native vegetation and reduce habitat quality for American bumble bee; sod grasses on upland sites and frequent mowing are particularly problematic

Edge Feathering: reduce tree cover adjacent to fields and encourage an herbaceous understory

Field Borders: designated to provide native herbaceous cover around crop fields and hayfields

Livestock Management: grazing should be managed to



B. Merle Shepard



maintain a diverse vegetation structure and promote and allow flowering

Plant Native Grasses and Forbs: where native grassland cover is limiting and planting is necessary, such as reclaimed mineland or when information is provided to indicate planting is necessary

Set-back Succession: Prescribed fire should be used to rejuvenate and maintain grasslands and herbaceous wetlands when conditions permit; Chaining and Drum-chopping can be used to reduce woody cover and encourage more herbaceous groundcover; Chainsawing, Dozer-clearing, and Root-plowing can be used to convert forest and extensive shrubland to more open grassland and early successional vegetation; Herbicide Applications can be used to reduce shrub and tree cover and encourage more early successional vegetation

Wildlife or Fish Survey: Survey where preferred flowers are present. Sweep nets, bee bowls, malaise traps, and vane traps can be used to survey this species. However, due to species declines and federal status, no-kill survey methods are preferred.

Monarch butterfly

General information

The monarch butterfly is one of the most popular species of insects in the world with its striking orange and black markings and incredible long-distance migration. It goes through a 4-stage life cycle: egg, caterpillar (larva), chrysalis (pupa), and adult. Monarchs are host specific, meaning they only lay eggs on various species of milkweed plants. Since monarch caterpillars feed exclusively on milkweed leaves, they sequester toxins poisonous to most would-be predators. Adults feed on nectar from a variety of flowering plants. Monarch caterpillars have yellow, black, and white stripes and reach lengths up to 2 inches with a 3-to-4-inch wingspan. The monarch butterfly is migratory and ranges from the northern plains of the United States and Canada, south to Mexico. Important wintering areas include the oyamel fir forests in central Mexico and forested areas in coastal California where monarchs use all parts of the trees. The species has been divided into two populations separated by the Rocky Mountains to improve conservation efforts. The eastern population completes its northward migration from Mexico through successive generations. Most adults only live for about a month. The last generation that hatches in late summer, however, can live 6-9 months and undergoes a spectacular fall migration. After overwintering in the mountains of Mexico, the last generation begins its journey north in March, goes through reproduction, then dies soon thereafter. The northward migration is continued by their offspring. The smaller western population ranges as far north as British Columbia during summer and overwinters as far south as coastal southern California.

Habitat requirements

Diet: larvae feed on various species of milkweed plants; adults feed on nectar from a variety of flowering plants and may also eat fruit, such as persimmon, pawpaw, and wild strawberry

Water: cannot land on water to drink, but may sip moisture from saturated soil

Cover: large, undisturbed early successional communities rich in flowering plants and especially an abundance of milkweeds; mountain forests for roosting during winter

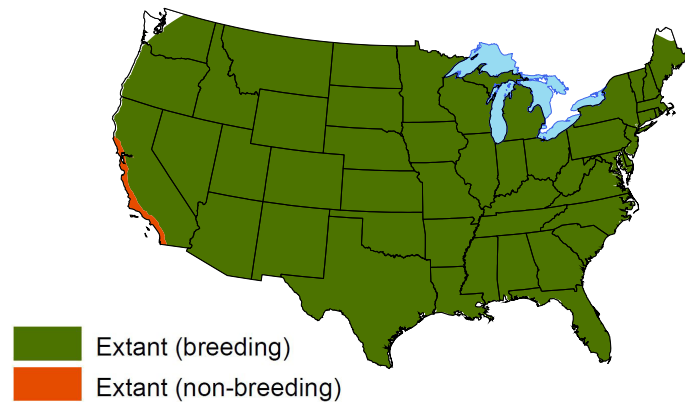
Wildlife management practices

Conservation Easement: to protect and manage large, contiguous early successional plant communities and wintering grounds

Control Nonnative Invasive Vegetation: when nonnative



Tom Koerner, USFWS



vegetation inhibits native plant abundance and reduces abundance of native milkweeds; coverage of nonnative sod grasses on upland sites and frequent mowing are particularly problematic

Delay Crop Harvest: avoid mowing patches of milkweed if possible when cutting hay since milkweed is toxic to cattle and horses and an important host plant for monarch butterflies

Edge Feathering: reduce tree cover adjacent to fields and encourage an herbaceous understory

Field Borders: to provide native herbaceous cover around crop fields and hayfields

Livestock Management: grazing should be managed to maintain a diverse vegetation structure and promote and allow flowering

Plant Native Grasses and Forbs: where native grassland cover is limiting and planting is necessary, such as reclaimed mineland; milkweeds should be part of the species mix; information may be provided to indicate if planting is necessary

Set-back Succession: Prescribed fire should be used to rejuvenate and maintain grasslands and herbaceous wetlands when conditions permit; Chaining and Drum-

chopping can be used to reduce woody cover and encourage more herbaceous groundcover; Chainsawing, Dozer-clearing, and Root-plowing can be used to convert forest and extensive shrubland to more open grassland and early successional vegetation; Herbicide Applications can be used to reduce shrub and tree cover and encourage more flowering plants

Wildlife or Fish Survey: Participate in the Monarch Larva Monitoring Project, the Monarch Watch, the Journey North, the North American Butterfly Association Butterfly Counts, and other standardized butterfly surveys.