**Oncorhynchus mykiss**  
Coast rainbow trout  
(Also: Hardhead; Kamloops; Redband; Salmon trout)

By Katherine Ridolfi

### Geographic Range

*Oncorhynchus* mykiss are only native to the Pacific Coast of North America, extending from Alaska down to the border between California and Mexico. However, they have been introduced throughout the United States and in every continent except for Antarctica for game fishing purposes. There are two forms: freshwater resident and anadromous. The resident form is commonly called rainbow trout while the anadromous form is called steelhead. (Delaney, 2005; "Oregon Coast Steelhead Evolutionary Significant Unit", 1998)

**Biogeographic Regions:** neartic (introduced, native); palearctic (introduced); oriental (introduced); ethiopian (introduced); neotropical (introduced); australian (introduced)

**Other Geographic Terms:** cosmopolitan

### Habitat

Freshwater, brackish, or marine waters of temperate zones. The anadromous form, called steelhead, spawn and complete their early development in freshwater mountain streams, then migrate to spend their adult life in the ocean. In freshwater, they prefer cool water but have been known to tolerate water temperatures up to 24°C (native climates have water temperatures around 12°C in the summer). Productive streams have a good mixture of riffles and pools and overhanging vegetation for shade. Most importantly, they require gravel beds to lay their eggs, and therefore, are sensitive to sedimentation and channel scouring. Juvenile trout prefer protective cover and low velocity water and have been known to be swept away and killed in water that is too fast. Since they are native to the western U.S., then tend to be found in coastal streams and rivers which naturally have reduced flow in summer months. (Behnke, 1992; Gall and Cranvell, 1992; "Life History Notes: Rainbow Trout", 2005)

**Habitat Regions:** temperate; tropical; saltwater or marine; freshwater

**Aquatic Biomes:** pelagic; lakes and ponds; rivers and streams; temporary
**Range elevation**
0 to 3000 m
0.00 to 9842.52 ft

**Range depth**
10 to 200 m
32.81 to 656.17 ft

**Range mass**
25.4 (high) kg
55.95 (high) lb

**Average mass**
4 kg
8.81 lb

**Range length**
120 (high) cm
47.24 (high) in

**Range basal metabolic rate**
0.6 to 75 cm3.O2/g/hr

**Average basal metabolic rate**
55 cm3.O2/g/hr

**Physical Description**
Physical description varies widely with sex, age, and habitat. In general, they are streamlined, with 8 to 12 spines in the anal fin and lack teeth at the base of the tongue (unlike their close relatives, *Oncorhynchus clarkii*). The undersides tend to be silvery with a pinkish red stripe along the upper-middle part of the body, though this stripe can vary from dark to light. Resident rainbows and spawning steelhead tend to be lighter with more pronounced pink stripes, while ocean-going steelhead are darker and silvery to blend into their ocean environment. Most have black spots above the lateral line, and resident rainbows tend to have more intense spotting, well below the lateral line. Juvenile fish have 8 to 13 parr marks on their sides and become silvery as they mature. (Delaney, 2005; Gall and Crandell, 1992; Klontz, 1991; Van Hulle, 2005)

**Other Physical Features:**
ectothermic; heterothermal; bilateral symmetry; polymorphic

**Sexual Dimorphism:**
males larger

**Development**
*Oncorhynchus mykiss* larvae go through a series of morphological changes to prepare for life in the sea, and spend their adult life there for 2 to 3 years before migrating upstream to spawn in their natal stream. ("The Life Histories of the Steelhead Rainbow Trout and Silver Salmon", 1954; Thrower, et al., 2004)

**Development - Life Cycle:**
metamorphosis

**Reproduction**
Female fish find suitable nest sites while their male mate guards the site from other interested males and predators. The female digs the nest (called a redd) with her anal fin and then descends upon it to position her vent and anal fin into the deepest part of the redd. The male joins her in a parallel position so that their vents are opposite each other. The male and female open their mouths, arch their backs, and deposit the eggs and milt (fish sperm) at the same time. The eggs are enveloped in a cloud of milt and are fertilized. Only a few seconds elapse from the time the female drops into the redd and fertilization occurs. The female then covers the nest with gravel and repeats the process again a few times until she has deposited all of her eggs. ("The Life Histories of the Steelhead Rainbow Trout and Silver Salmon", 1954)

**Mating System:**
polygynous

Adult rainbow trout and steelhead lay their eggs in a series of nests in...
Breeding interval
Rainbow trout breed every three to five years. Though steelhead are one of the only salmonids able to spawn twice in a lifetime, the return rate is very low, about 10-20%.

Breeding season
Spawning occurs from March to July, depending on temperature and other climatic variables. Winter steelhead in California start spawning as early as January.

Range number of offspring
200 to 8000

Average number of offspring
3500

Range time to hatching
3 to 16 weeks

Range time to independence
one to three years

Range age at sexual or reproductive maturity (female)
3 to 11 years

Range age at sexual or reproductive maturity (male)
3 to 11 years

Female rainbow trout and steelhead simply lay their eggs in a gravel bed and leave the young hatchlings to mature on their own. Male steelhead frequently breed with multiple female partners, possibly because more females than males die during the breeding period. (Delaney, 2005)

Parental Investment: no parental involvement; pre-fertilization (provisioning, protecting: female); pre-hatching/birth (protecting: female); inherits maternal/paternal territory

Lifespan/Longevity
Oncorhynchus mykiss individuals live for 6 to 8 years in the wild, possibly up to 11 years. (Gall and Crandell, 1992; "Steelhead: Oncorhynchus Mykiss", 2005)

Behavior
Steelhead and rainbow trout are solitary fish, leaving the group of juveniles once they have hatched from eggs. As adults, they compete with all kinds of trout and salmon for food and habitat. The largest trout tend to...
get the best habitat. Adult steelhead have a remarkable homing instinct and consistently return to their natal stream to spawn. Steelhead have been known to migrate thousands of kilometers between the ocean and their natal stream to spawn. Migration ranges have been severely cut due to excessive damming of most western rivers and streams. ("The Life Histories of the Steelhead Rainbow Trout and Silver Salmon", 1954; Alexander, 1991; Behnke, 1992)

**Key Behaviors**: natatorial; motile; migratory; solitary; territorial; dominance hierarchies

### Range territory size
10 to 5000 km²

### Home Range
Resident rainbow trout maintain small territories but also disperse from areas with higher population densities in order to find food. ("The Life Histories of the Steelhead Rainbow Trout and Silver Salmon", 1954; Behnke, 1992)

### Communication and Perception
There is little communication between rainbow trout and steelhead. Once the fry emerge from the gravel, they become hostile to each other and compete for habitat. Larger fish usually win out the best habitat and food sources, and there is a size hierarchy within aquatic systems among all trout species. Potential mates communicate before spawning with visual cues. *Oncorhynchus mykiss* individuals are visual predators, relying on a keen sense of vision to detect prey. Trout species use both chemical cues and detection of the earth’s magnetic fields to navigate to and from natal streams and on ocean journeys. (Grubb, 2003)

**Communication Channels**: visual; tactile

**Perception Channels**: visual; tactile; chemical; magnetic

### Food Habits
Rainbow trout and steelhead are insectivorous and piscivorous. Resident rainbow trout tend to eat more fish than steelhead. Both species primarily feed on invertebrate larvae drifting in mid-water to conserve energy that would be expended if they were foraging for food in the substrate. Young rainbow trout and steelhead eat insect larvae, crustaceans, other aquatic invertebrates, and algae. (Behnke, 1992; Delaney, 2005; Klontz, 1991; "Steelhead: Oncorhynchus Mykiss", 2005; Smith, 1991; Van Hulle, 2005)

**Primary Diet**: carnivore (insectivore)

**Animal Foods**: fish; insects; aquatic or marine worms; aquatic crustaceans

**Plant Foods**: algae

### Predation
In the Great Lakes, sea lampreys are the most common predators of all salmonid species, including rainbow trout. Other predators in both native and introduced habitats include: larger trout, fish-eating birds like great blue herons (*Ardea herodias*), mergansers (*Mergus*), and kingfishers (*Ceryle*), and mammals including mink (*Neovison vison* and *Mustela lutreola*), raccoons (*Procyon lotor*), river otters (*Lontra*), grizzly bears (*Ursus arctos*), American black bears (*Ursus americanus*), humans, and larger marine mammals who feed on migrating steelhead. Rainbow trout tend to stick to the sides of streams and rivers where shading is prevalent, the water is less swift, and protection is greatest. Trout species are vigilant and capable of rapid swimming to escape predation. ("Steelhead: Oncorhynchus Mykiss", 2005; Smith, 1991)
Known Predators
- kingfishers (*Ceryle*)
- grizzly bears (*Ursus arctos*)
- American black bears (*Ursus americanus*)
- river otters (*Lontra canadensis*)
- mink (*Neovison vison* and *Mustela lutreola*)
- raccoons (*Procyon lotor*)
- sea lampreys (*Petromyzon marinus*)
- mergansers (*Mergus merganser*)
- great blue herons (*Ardea herodias*)
- other trout species (*Salmonidae*)
- humans (*Homo sapien*)

Ecosystem Roles
Rainbow trout and steelhead are important predators in their native habitats, they also serve as important sources of food for larger predators. *(Smith, 1991)*

Commensal/Parasitic Species
- sea lamprey (*Petromyzon marinus*)

Economic Importance for Humans: Positive
These fish are one of the most popular game fishes around the world, leading to nearly global introduction. They are introduced to stimulate local angling and associated recreational economies. However, where they are introduced, they can outcompete native trout species. *("Steelhead: Onchorhynchus Mykiss", 2005; "Oregon Coast Steelhead Evolutionary Significant Unit", 1998; "Life History Notes: Rainbow Trout", 2005)*

| Positive Impacts: food | ecotourism |

Economic Importance for Humans: Negative
Rainbow trout have been introduced throughout the world, negatively impacting species of native freshwater fishes and, therefore, native fisheries.

Conservation Status
Steelhead are endangered in Washington and California, and threatened in California, Oregon, Washington, and Idaho. Most of their decline has resulted from impacts to habitat and shrinking of spawning routes due to dams and other diversions. Siltation, caused by forestry practices, and erosion, caused by urban and agricultural development, has also impacted spawning beds. *(Behnke, 1992; Delaney, 2005; "Oregon Coast Steelhead Evolutionary Significant Unit", 1998; Van Hulle, 2005)*

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<th>IUCN Red List</th>
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References


Animal Diversity Web (ADW) is an online database that collects the natural history, classification, species characteristics, conservation biology, and distribution information on thousands of species of animals. It includes thousands of photographs, hundreds of sound clips, and a virtual museum. The ADW acts as an online encyclopedia, with each individual species account displaying basic information specific to that species. The website used a local, relational database written by staff and