Sockeye Salmon

Image from
http://wdfw.wa.gov/fishing/salmon/graphics/Sockeye

Oncorhynchus nerka

Onkos = hook
Rynchos = nose

Physical Description:

Sockeye salmon are one of the smaller species of Pacific salmon. They can grow to fifteen lbs but on average are eight lbs and up to three feet in length. While spawning, the adults are unique in appearance. They typically turn bright red with a green head, hence they are commonly called "red" salmon. During the ocean phase, sockeye often have bluish backs and silver sides, giving rise to another common name, "bluebacks." Sockeye have a white mouth with a white gum line, almost no teeth, no spots on tail or back, and large, bright gold glassy eyes.

Natural History:

Sockeye salmon life histories and population structure can be subdivided into broad categories as is done here. These broad categories are central themes around which a great deal of diversity has evolved in sockeye. For conservation purposes, maintaining life history diversity is key.

Species Subtypes:

There are two distinct types of sockeye salmon.

Anadromous: Like other Pacific salmon, most sockeye salmon hatch in freshwater streams and rivers then migrate to the ocean to feed and grow.

Non-Anadromous or kokanee: Some sockeye salmon are not anadromous and spend their entire lives in freshwater. In the Pacific Northwest, non-anadromous sockeye are known as kokanee.

Spawning:

Sockeye are unique in that they require a lake to rear in as fry. They can adapt to a wide range of water velocities and substrates. Females spawn in three to five redds (nests) over a few days and hatching occurs six to nine weeks later. Like most Pacific salmon adults die after spawning.

Large rivers with sufficient spawning and rearing room historically supported huge runs of sockeye, numbering into the millions. One that still exists is the Adams River in British Columbia, a tributary to the Fraser. The Canadian government has built viewing platforms for visitors, and annual runs of over a million sockeye are common.

Life Cycle:
Young sockeye life stages:

- Alevin - salmon life stage between an egg and a fry. At this stage, the alevin do not have a protective shell and are essentially small fish with an attached yolk sac from which to derive nourishment. After the yolk sac has been completely absorbed the alevin leave the redd.
- Fry - a juvenile salmon that has absorbed its egg sac. Most sockeye fry rear in lakes.
- Parr (also known as a fingerling) - a large juvenile salmon that has vertical 'parr' bars and spots useful for camouflage.
- Smolt - a juvenile salmon that is preparing to enter the ocean. Parr marks disappear and are replaced by the dark back and light belly of fish in open water. Gills and kidneys begin to change so they can process salt water.

Sockeye salmon typically mature and return to freshwater after two to three years at sea, but some return earlier or stay at sea longer. In some lakes, especially in the Fraser River system, sockeye display a phenomenon called "cyclic dominance" in which one age group dominates and they are abundant in one of every four years. This cyclic dominance leads to spectacular returns to the Adams River every four years. There are many ideas about why this occurs but nobody knows for sure. Sockeye appear to be highly adapted to their natal lake. Migration route, timing of spawning and time of emergence are particular to individual lakes which makes each sockeye population genetically unique but also means that it is difficult to successfully move them from one lake to another.

Range:

Sockeye salmon are found on both sides of the North Pacific Ocean. In North America, they range from northwestern Alaska to the Klamath River in Oregon. In Asia, they're found from Siberia south to Hokkaido, Japan.

Diet:

Juvenile sockeye feed mainly on zooplankton, amphipods and aquatic insects. In the ocean, sockeye salmon continue to feed on zooplankton but also eat larval and small adult fish, squid and small crustaceans.

Status:

Of seven distinct ESUs (evolutionary significant units) of sockeye salmon identified in the Pacific Northwest of the USA, one (Snake River) is listed as endangered and one (Lake Ozette) is listed as threatened under the ESA. Before the turn of the twentieth century, an estimated 150,000 sockeye salmon returned annually to the Snake River basin. In recent years, the average annual return of natural origin sockeye has been under 500. Historically, the Lake Ozette sockeye run is believed to have exceeded 50,000 fish prior to the 1940s. Although numbers are highly variable year to year, the most current data indicate there are only around 2,679 wild sockeye spawners in the Lake Ozette watershed.

In Canada, the Cascadian Fraser River sockeye run is the largest sockeye run in the world but it has experienced continual unexpected declines and is being considered listed under Canada's Species at Risk Act (SARA). In fact, recommendations under COSEWIC (Committee on the Status of Endangered Wildlife in Canada), were made to list eight of the twenty four sockeye populations in the Fraser River as endangered, two as threatened, and five as "special concern." No single cause has been identified for the declines but there are a number of possible factors that could be influencing this stock. Additionally, COSEWIC recommended listing the Sakinaw population of sockeye as endangered. To date, none of these populations are listed under Canada's Species at Risk Act (SARA). Sockeye salmon currently have a status of "least concern" under the IUCN Red List of Threatened Species.

Threats:

The major threats for Pacific salmon have been identified as the 4 Hs:

- Harvest - sockeye is the most valuable U.S. salmon species for both the meat and the roe which is used to make salmon caviar. They are mostly caught in gill and seine net fisheries.
- Habitat - chemical pesticides can alter the 'smell' of the stream disrupting homing mechanisms. Soaps and detergents can clog the gills of fish and result in high mortality. Copper from brake pads can be toxic to salmon in fresh water. Land-use activities such as logging, road construction, urban development, mining, agriculture, and recreation result in habitat modification. Examples of habitat modification include: alterations in steam banks, changes in stream water temperatures and water quality, reduction in available prey, elimination of spawning and rearing habitat, and removal of native vegetation which results in erosion and increased sedimentation. Most western states have lost 80 to 90 percent of their historic riparian habitat. Over the past 200 years, the lower 48 states have lost over 50% of their wetlands. Most of the estuaries in Washington, which are especially important to salmon smolts, have been altered by dredging, diking, filling of wetlands and tidal areas, and degraded water quality.

- Hydro - dams have reduced or eliminated accessible habitat and resulted in high mortality of salmon. Changing the natural flow of dammed rivers results in increased water temperature and reduced water flow necessary for migration, spawning, rearing, sediment flushing from spawning areas and transport of debris, all of which have a negative effect on salmon.
- Hatcheries - extensive hatchery programs were established to mitigate fisheries and habitat destruction. While hatcheries successfully provide fishing opportunities, impacts on wild salmon may include competition, genetic hybridization, and disease transmission. Fisheries that target mixed stock of hatchery and wild salmon can over harvest the wild fish. Hatchery fish have decreased fitness due to being fed pellets, and therefore not having to search for food, as well as being protected from predation.

In addition to these threats there is increasing concern over the effects that salmon farming has on wild Pacific salmon populations. Some of the detriments of salmon farms include escapement of non-native Atlantic salmon, lethal outbreaks of sea lice, antibiotic resistance, disease, and toxins, all of which can affect wild salmon. Climate change is also a concern as it can increase the risk of diseases in wild salmon and reduce the quality and quantity of water in spawning habitat. Short term changes in weather such as El Nino and La Nina, which dictate rainfall levels, can have devastating effects on salmon populations for a given year. Additional information on threats to Pacific salmon can be found at https://www.fisheries.noaa.gov/data-tools/west-coast-salmon-vulnerability-species-specific-results.

Conservation Efforts:

There are a variety of conservation efforts currently being undertaken. Recovery plans for sockeye salmon can be found at https://archive.fisheries.noaa.gov/wcr/protected_species/salmon_steelhead/recovery_planning_and_implementation/. Removal and modification of dams that obstruct salmon migration has been undertaken. A successful example of this is the Elwha Dam Removal Project in Washington State. More information on this project can be found at http://www.nps.gov/olym/naturescience/elwha-ecosystem-restoration.htm. Restoration of degraded habitat and improved water quality are being attempted in many areas.

The Puget Sound Partnership is the regional salmon recovery organization for Puget Sound salmon. They are focusing on protecting and restoring habitat, raising awareness, reforming hatchery management, and developing and monitoring an adaptive management strategy. More information about the Puget Sound Partnership can be found at https://psp.wa.gov/.

In addition, the Pacific Coastal Salmon Recovery Fund (PCSRF) was established by Congress in 2000 to support the restoration of salmon species. The fund is overseen by NMFS (also known as NOAA) and carried out by state and tribal governments. PCSRF grantees, such as the Washington Department of Fish and Wildlife (WDFW), contract with local watershed groups, conservation agencies, land trusts, and other entities to manage

salmon habitat restoration projects. In turn, those agencies contract with local businesses and suppliers to carry out the work.

Fun Facts:

- The name "sockeye" is thought to have been a corruption of the various Indian tribes' word "sukkai" or “suk-kegh,” meaning fish or red-fish.
- Sockeye were the first species to be caught commercially.
- Sockeye flesh gets its color from the orange krill they eat while in the ocean.
- Sockeye are the third most abundant Pacific salmon species and are a keystone in the North American commercial fisheries.
- Research from NOAA Fisheries has not found that Southern Resident orcas consume much sockeye, making up only 1.3% of known summer diet.

Sources:

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Sockeye salmon photo by Cascadia Partner Forum

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