Methow River Fish Guide

The dramatic decline of several salmon species in the Columbia River Basin has resulted in the federal listing of these species as "Endangered" or "Threatened" under the Endangered Species Act. The Methow River watershed is one of many Columbia River tributaries undergoing intensive restoration and monitoring as a result of these listings. Efforts to identify the extent and contributing factors of these declines, as well as potential solutions, have all increased in recent years in order to promote fish recovery.

Numerous federal, state, tribal, and private entities are involved in efforts to restore healthy populations of native fish, and improve aquatic habitat and water quality. Studies to determine population numbers, assess water quality, identify and reduce human caused threats, and more are all taking place within the Methow and other Columbia River subbasins. Information from these studies is being used to develop and implement strategies aimed at protecting and restoring habitat, improving water quality, and increasing survival of the listed fish.

This guide seeks to provide fisheries students, educators, sport fishers, naturalists, and others with a valuable tool for further understanding the local fish community. Current information related to life history, distribution, and identification is included for native species. A general overview of available information for non-native species is also included.

It is hoped that by helping develop a greater understanding of the local fish inhabitants and their needs, we can encourage efforts to help maintain populations of the Methow River's fish species, and a healthy river with good water quality that will provide benefits to the human community for generations to come.

The Methow River Watershed sign was developed by Trevin Leon.

Methow River Fish Guide

A guide to the distribution, identification, and ecology of fish species found in the Methow River watershed

Second Edition
Revised and Expanded

John Crandall and
Eric Wittenbach

Acknowledgments

This guide was produced by the Methow Salmon Recovery Foundation with funding through several sources including the Washington Department of Ecology and Bonneville Environmental Foundation. Many individuals contributed with the development of the guide through the provision of information related to fish life history and distribution, recovery planning, monitoring, and habitat restoration. Several individuals provided detailed reviews of either the first or second edition including: Charlie Snow (Washington Department of Fish and Wildlife), Jennifer Molesworth (US Bureau of Reclamation), Wesley Tibbets (Colville Confederated Tribes), Molly Hallock (Washington Department of Fish and Wildlife), Michael Humling (US Fish and Wildlife Service), Robert Warren (Bonneville Environmental Foundation), Jamie Glasgow (Wild Fish Conservancy), Kristen Kirkby (Cascade Columbia Fisheries Enhancement Group), Heather Simmons (Washington Department of Ecology), and Bruce Reiman (US Forest Service ret.). Their comments greatly improved the quality of the guide and we are thankful. In the development of this guide, we strived to include locally produced photographs and drawings throughout. We largely succeeded in this endeavor, and thank Michael Humling, John Crandall (Methow Salmon Recovery Foundation), Chris Johnson (Methow Salmon Recovery Foundation), Michael Durham, Kristen Kirkby (CCFEG), Trevin Leon, Mary Kiseau (Methow Conservancy), Rick Alford (Yakama Nation Fisheries), and Eric Wittenbach. Some photos were of an unknown orgin and thus lack credit.

Cover photo: adult male bull trout, credit Kristen Kirkby.

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To learn more about salmon recovery and water quality improvement efforts in the Methow watershed, visit www.methowsalmon.org and www.methowrestorationcouncil.org.

Funding for the Methow Fish Guide provided by:

DEPARTMENT OF ECOLOGY State of Washington

METHOW SALMON RECOVERY FOUNDATION

BONNEVILLE ENVIRONMENTAL FOUNDATION

Contents

Introduction

Welcome to the second edition of the Methow Fish Guide! This guide is intended to serve as a tool for scientists, anglers, river enthusiasts, students, teachers, and anyone else with a desire to learn more about the freshwater fish community inhabiting the Methow River watershed. The guide is also intended to promote awareness of the need for clean water and appreciation of the lesser known fish species living in the waters of the Methow.

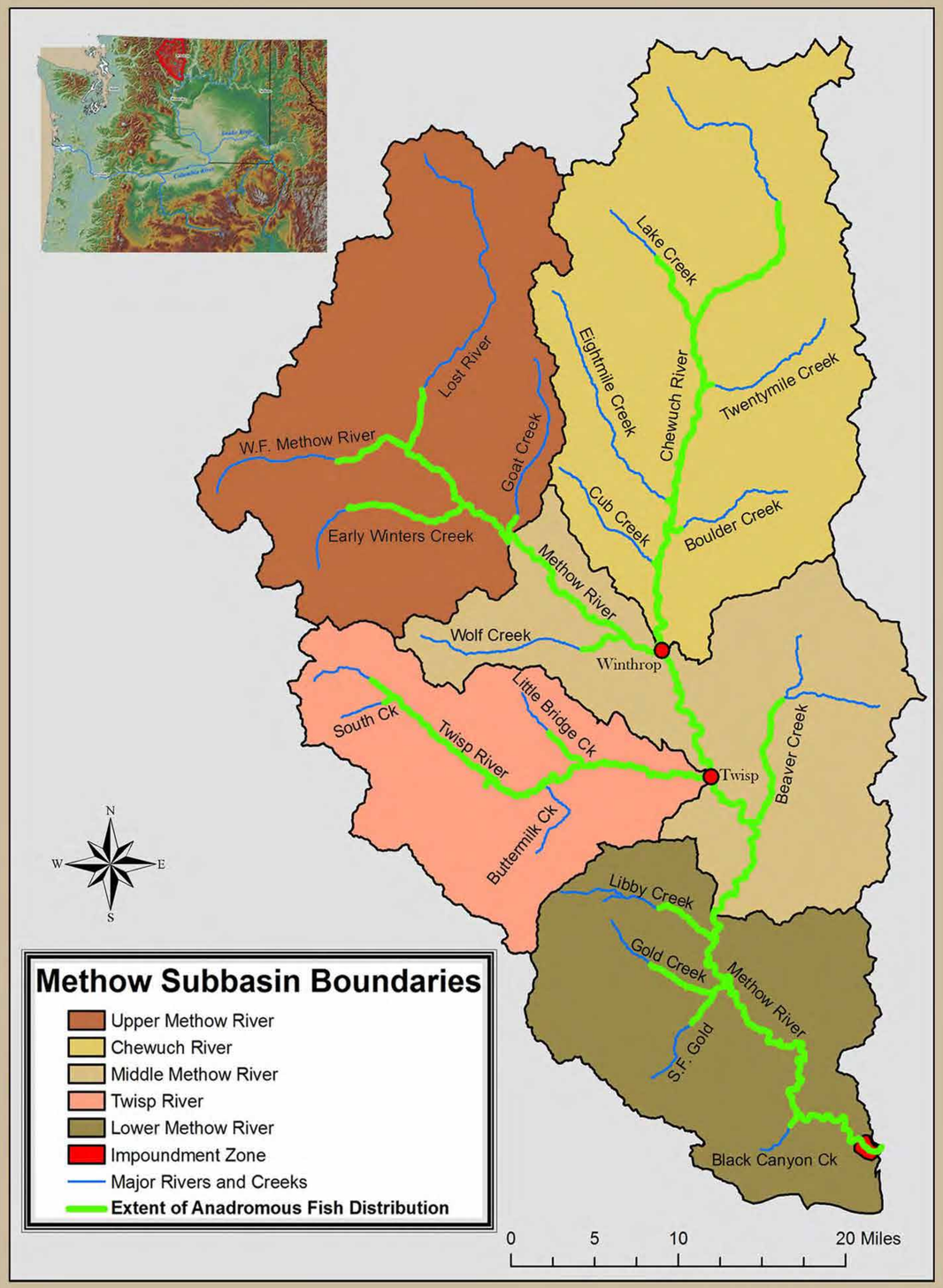
Native fish of the Methow River and its tributaries are vital components of a complex aquatic ecosystem. The fish, whether anadromous spring-run Chinook salmon and Pacific lamprey, or resident bridgelip suckers and westslope cutthroat trout, function in part to maintain the ecological balance within the streams of the Methow watershed. Depending on the species and life stage, fish function as both predator and prey and thus provide important links within the aquatic food web. Salmon and lamprey returning from the ocean bring with them vital nutrients that are deposited throughout the freshwater ecosystem when they die. These marine-derived nutrients "fertilize" local streams increasing their productivity. Fish also provide food for terrestrial species such as plants, black bears, and even wolves, thereby extending the energetic influence of the fish far beyond the streambank.

The Methow's fish community also represents an important aesthetic, social, and cultural resource for humans. Fish provide recreational fishing and viewing opportunities, a source of food, and an overall appreciation that can be passed on through the generations. Indeed, fish have been a significant part of the cultural heritage of native Americans for millennia.

Bull trout spawning in a tributary of the upper Methow River. Clean and cold water is an important characteristic of a healthy river, especially for temperature-sensitive species like bull trout.

The Methow Watershed

The Methow River Watershed is located in north-central Washington along the eastern slope of the North Cascades mountain range. The south-easterly flowing Methow River drains an approximately 1.1 million acre watershed into the Columbia River near Pateros. The map below displays the six subbasins described on pages 15-16. Known distribution for fish species covered in this guide is identified for each subbasin on page 17.



The Benefits of Clean Water

Freshwater fish in the Methow require cold, clean water in order to thrive and are sensitive to any degradation of the waters they live in. As such, the fish inhabiting the Methow's rivers, creeks, lakes, and ponds are important indicators of water quality, which is defined as the physical, chemical, and biological characteristics of water.

Temperature is an especially critical component of water quality. The fish in the Methow are cold-blooded and temperature plays an important role in regulating growth, migratory behavior, reproduction, and, ultimately, survival. Methow fish are adapted to what humans would consider cold water. For example, the optimal temperature for many of these fish ranges between 45-60ºF (7-16ºC). If water temperature rises much above these levels, the fish can become stressed, which negatively affects their growth and survival, and increases their susceptibility to disease.

Water temperature, and other water quality parameters such as dissolved oxygen and pH, vary on a daily and seasonal basis. Water temperatures are generally coldest during winter and warmest during the summer. Currently, summertime stream temperatures in the Methow River exceed Washington State criteria, which has resulted in violations of the Federal Clean Water Act.

A healthy watershed provides opportunities for many activities.

The Methow Restoration Council (MRC) has initiated a basinwide water quality monitoring program to investigate seasonal water quality and temperature status and trends. The MRC is also engaged in the restoration of riparian habitat through tree plantings. As the trees grow they will shade the water and help to keep water cool and within acceptable levels for fish.

Riparian Forests and Stream Health

Riparian forests are transitional areas between the active river channel and upland habitats. Riparian forests include forested and shrubby vegetation bordering rivers, creeks, wetlands, springs, and seeps. These areas provide many functions essential to fish and habitat health including: shade, sources of large wood, bank stabilization, nutrient input, and water storage.

Shade provided by riparian vegetation helps to maintain cool stream temperatures. Many fish species, particularly salmonids, require cold water temperatures. Large wood in and around the stream channel provides cover for fish, helps control stream flow, and creates fish habitat through the development of pools and riffles. Standing trees and shrubs stabilize stream banks and dissipate floodwaters, preventing excessive erosion and sedimentation that can damage fish spawning areas. Riparian areas store water for late-season release to streams. This function is particularly important in semi-arid environments such as the Methow, where late-season low flows and high water temperatures can negatively impact fish.

Riparian habitat can be adversely impacted by several human activities, including road construction, residential development, some agricultural practices, and the clearing of trees, shrubs, and ground cover.

Healthy, functional riparian zones provide a suite of benefits to streams.

One of the ways that riparian habitats can be protected on private land is through the creation of conservation easements. A conservation easement is a voluntary agreement, established between a landowner and a local land trust or other authorized entity. The easement serves to protect riparian areas by limiting allowed uses to those that support healthy riparian habitat and natural stream function.

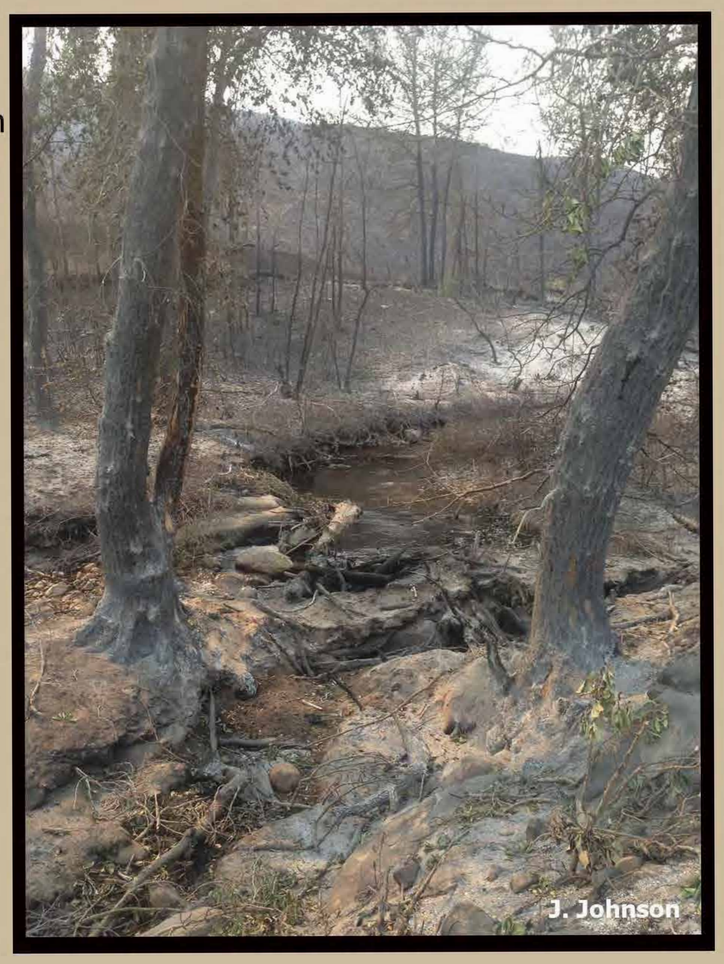
In the Methow Valley, our local land trust, The Methow Conservancy, works with willing private landowners to establish riparian conservation easements. To date, the Methow Conservancy has completed 110 conservation easements protecting over 32 miles of riparian shorline. It is important to note that a conservation easement does not provide for public access to the river. Always obtain permission before crossing private property to access the river.

Stream Response to Wildfire

The wildfires that burned through the Methow watershed in 2014 and 2015 were notable for their size and severity, as well as the destructive impacts to surrounding communities and infrastructure. In total, the fires burned 270,000 acres which represents 25% of the entire watershed area. After the fires, local residents, with strong support and resources from outside the Valley, responded to immediate needs for human well-being and safety and began the process of long-term fire recovery.

The fires also had significant impacts on local streams and fish populations. At first glance, the impacts from fire appear to be destructive, yet streams and their inhabitants are adapted to, and benefit from, these types of disturbances. How a particular stream responds depends greatly on the timing, extent, and intensity of the fire, as well as the condition of the stream prior to the disturbance. Generally speaking, streams that are in better condition pre-fire are more resilient and recover more quickly compared to streams in poor condition.

Fires impact streams, both in the short (a few years) and long-term (decades), through several key pathways, including changes to channel stability, hydrologic regime, sediment transport, large wood supply, and riparian cover. For example, fires can severely burn vegetation and soils, decreasing water retention in the uplands and leading to more water flowing into the stream channel. The subsequent increases in streamflow can cause flooding and debris flows, erode banks, and transport large quantities of fine sediment which may exacerbate poor conditions in degraded streams. When fires burn through riparian forests, an occurrence that was widespread throughout the Carlton Complex fire, the diminished shade increases solar inputs to the stream, which results in elevated water temperatures.



The Carlton Complex Fire burned extensively through riparian forests. Post-fire high flows scoured the stream channel and caused significant amounts of bank erosion. As a result of these processes, new stream channels were formed including the one pictured here in lower Beaver Creek.

Fire affected riparian forest post Carlton Complex Fire 2014.

Yet the same changes to streams that appear destructive in the short-term often set the stage for subsequent changes that will increase habitat diversity, thus overall stream health, in the long-term. Large wood that falls into the stream when banks erode provides valuable cover for fish and often redirects stream flow to form pools and deposit spawning gravel. Fire also stimulates growth of riparian plants that are surprisingly well adapted to this type of disturbance. Although it takes several years, post-fire riparian forests often respond with increased species diversity and vigor, and in time will once again provide shade to the stream.

Fish populations thrive on diverse instream habitat that is supported by cold and clean water, yet are well adapted to changes in their stream environment and respond accordingly when post-fire shifts occur. Although direct mortality does occur when water temperatures or sediment loads get too high, fish instinctively will move out of affected waters to find refuge elsewhere – as long as adequate passage conditions exist. They will also rapidly recolonize areas they were displaced from after conditions settle back into tolerable ranges. Over time, degraded habitat can develop into a highly productive area that supports a healthy fish population.

Riparian forests are adapted to periodic wildfire as illustrated by the vigorous regeneration observed in Beaver Creek three years after the Carlton Complex Fire.

Threats to Watershed Health

Although the Methow River ecosystem and its fish populations are healthy in many respects, they face several challenges and potential threats to the quality of their habitat shared by other rivers in the Northwest. Many of these threats are local in nature while others demonstrate how the Methow River is linked to the larger world and the health of outside ecosystems. Several of the threats linked to habitat quality in the Methow River are described below.

Reduced Stream Flows and Water Storage Capacity- Reduced stream flows resulting from irrigation diversions and drought can elevate river temperatures and reduce available fish habitat. River straightening levees and other human modifications, combined with a loss of beaver created wetlands, have reduced the river's natural holding capacity of spring runoff. Reduced holding capacity can cause lower flows earlier in the season and warmer water temperatures. De-watering of streams can occur during low flows in the heat of the summer when irrigation demand is high. Much work has been done in recent years to improve the efficiency of irrigation systems, resulting in reduced human demand while allowing adequate water for agricultural uses.

Rivers require floodplain access during high water events to function properly and offer a diversity of habitats to fish.

Loss of Floodplain Access- Floodplains are the relatively flat areas adjacent to streams that are periodically covered by water during floods, and are commonly associated with riparian forests, sloughs, and side channels. When active, floodplains provide cover, food, and refuge from high-velocity floodwaters for many species of fish. Floodplains are especially vital to juvenile fish that lack the swimming ability to remain in the main river during high water. The construction of levees, clearing of riparian forests, and loss of beaver have combined to reduce the extent and availability of floodplains. As a result, fish have lost a significant amount of a vital habitat that supports increased growth and survival.

Loss and Modification of Riparian Habitat- Historical and current vegetation removal along streams is a major threat to stream quality. Riparian vegetation provides cooling shade and instream cover for fish. It also helps minimize erosion. Modification of river banks often follows loss of riparian vegetation. Boulders, concrete, and even cars, have been used to try to stabilize eroding banks. This would generally be unnecessary if riparian vegetation was left intact.

Chemical or Toxic Pollution- Salmonids and other fish species are highly sensitive to chemical pollutants such as oils, fertilizers, pesticides, pharmaceuticals, and herbicides. These toxic materials can enter the river from many sources including accidental (residential or commercial) spills, general usage by agriculture, and improper disposal of toxic materials.

Barriers to Migration- Nine hydropower dams on the Columbia River impede migratory behavior and cause mortality to anadromous fish on their journey to and from the Pacific Ocean. Locally, fish passage may be impeded by diversion dams and culverts associated with roads where they cross streams. Some of these barriers in the Methow watershed have been upgraded to provide better fish passage, but many remain.

Invasive Species- Non-native fish, mollusks, crustaceans, and plants, pose threats to native fish populations. Aquatic weeds can degrade habitat and invasive fish can prey on or hybridize with native fish. Lacking natural predators invasives can spread unchecked and out-compete native species for limited food sources. Invasives can spread by boats, modification of habitat, introduction by fish stocking, wading boots, or travel upstream from other tributaries they have colonized.

Ocean Conditions- Though hundreds of miles away, the health and productivity of the Methow River ecosystem is directly linked with the health of the Columbia River estuary, the Pacific Ocean, and the aquatic and riparian ecosystems in-between.

When development occurs in historical floodplain zones, landowners may find themselves in a battle with the river. Old cars and other debris are signs of efforts to harden the river's banks and reduce natural migration of the river into floodplain areas.

Hatcheries

Fish hatcheries were first established in the Columbia River Basin over 100 years ago to supply salmon and steelhead for harvest. Overfishing that led to sharp declines in fish populations soon after European settlement of the Pacific Northwest was a major driver for the development of the first hatcheries. Currently, the Methow has two hatcheries located along the Methow River just upstream from Winthrop. These facilities raise Chinook, coho salmon, and steelhead.

While hatchery fish production has been successful at producing more fish, it has not succeeded as a sole means of sustaining fish recovery. With the listing of 13 runs in the Columbia River Basin under the Endangered Species Act, interest and concern have grown about the effects of hatchery fish on stocks of wild fish. Hatchery fish are less "fit" compared to wild fish and do not survive as well in stream environments. When a hatchery propagated fish spawns with a wild fish, the survival rate of their progeny will be lower than if two wild fish spawned. As such, hatchery fish presence in the wild poses risks to the recovery of wild fish.

Bonneville Power Administration, Army Corps of Engineers, Bureau of Reclamation, NOAA Fisheries, Native American tribes, and local public utility districts fund hatchery programs to mitigate for the impacts to fish resulting from the construction and operation of the dams along the Columbia and Snake Rivers. There are over 200 hatchery programs in the Columbia River Basin. In the Upper Columbia alone these programs account for the release of approximately 20 million fish per year.

It is hoped that hatchery programs aid conservation of wild fish and not impede the long-term recovery goals of listed salmon and steelhead. Many hatchery programs have been modified in recent years to help reduce the genetic and ecological effects on wild fish. Use of native stocks for broodstock, rearing practices that help raise stronger hatchery stocks, and reducing hatchery fish presence on the spawning grounds are examples of some of the reforms.

Hatcheries generally use surface or groundwater diversions to support the growing fish. This water is diverted from the stream, or is pumped from a well, and then returned to the river, thus there is little consumptive use. But return water can often be diminished in quality as it moves through the rearing ponds where it warms and collects fish waste that is high in phosphorus and nitrogen and elevated levels of other chemicals.

Inclusion of wild fish in hatchery fish production has assisted in the development of more genetically diverse hatchery stock.

Habitat Restoration

In response to declines in fish populations and in recognition of the degraded fish habitat that exists in the Columbia River Basin, including the Methow River, extensive work is underway to improve habitat quality to benefit fish. While the basis for this effort is to assist in the recovery of ESA-listed spring Chinook, summer steelhead, and bull trout, the improved habitat conditions should benefit the entire native fish community in the Methow.

Recovery efforts include both habitat protection and restoration. While habitat protection is aimed at preserving the remaining high-quality habitat, habitat restoration is focused on improving the condition of areas that are not properly functioning from a stream health perspective. Both approaches are important and necessary considering the large size of the watershed, as well as the range in habitat conditions that vary from nearly pristine to extensively degraded.

While there are many types of actions that can be implemented to improve habitat quality and function in and adjacent to streams, most are focused on addressing the factors that are identified as responsible for limiting fish productivity. In the Methow, these "limiting factors" include low instream flow, diminished instream complexity and floodplain connectivity, degraded water quality, and reduced extent of riparian vegetation. Most reaches of stream in the Methow have been extensively studied to determine the types and extent of limiting factors present. Restoration projects are then developed to address the limiting factors that are impacting a particular reach of stream. In many cases, several factors are present at the same location, which calls for multi-faceted projects with components designed to address the suite of limiting factors.

Planting of riparian vegetation is a common restoration practice in the Methow watershed to increase shade and maintain cool water temperatures.

Habitat Restoration (continued)

One type of restoration project that can be readily observed at several locations in the Methow are the installed large wood structures. These complexes of interwoven or stacked logs are designed to replicate the function of natural wood that has been cut or removed. The structures increase fish cover and promote pool formation and localized water velocity diversity, including areas of both fast and slow current. The habitat created by these engineered structures are attractive to fish as locations to avoid predators, find food, and seek refuge from fast water currents present during spring runoff.

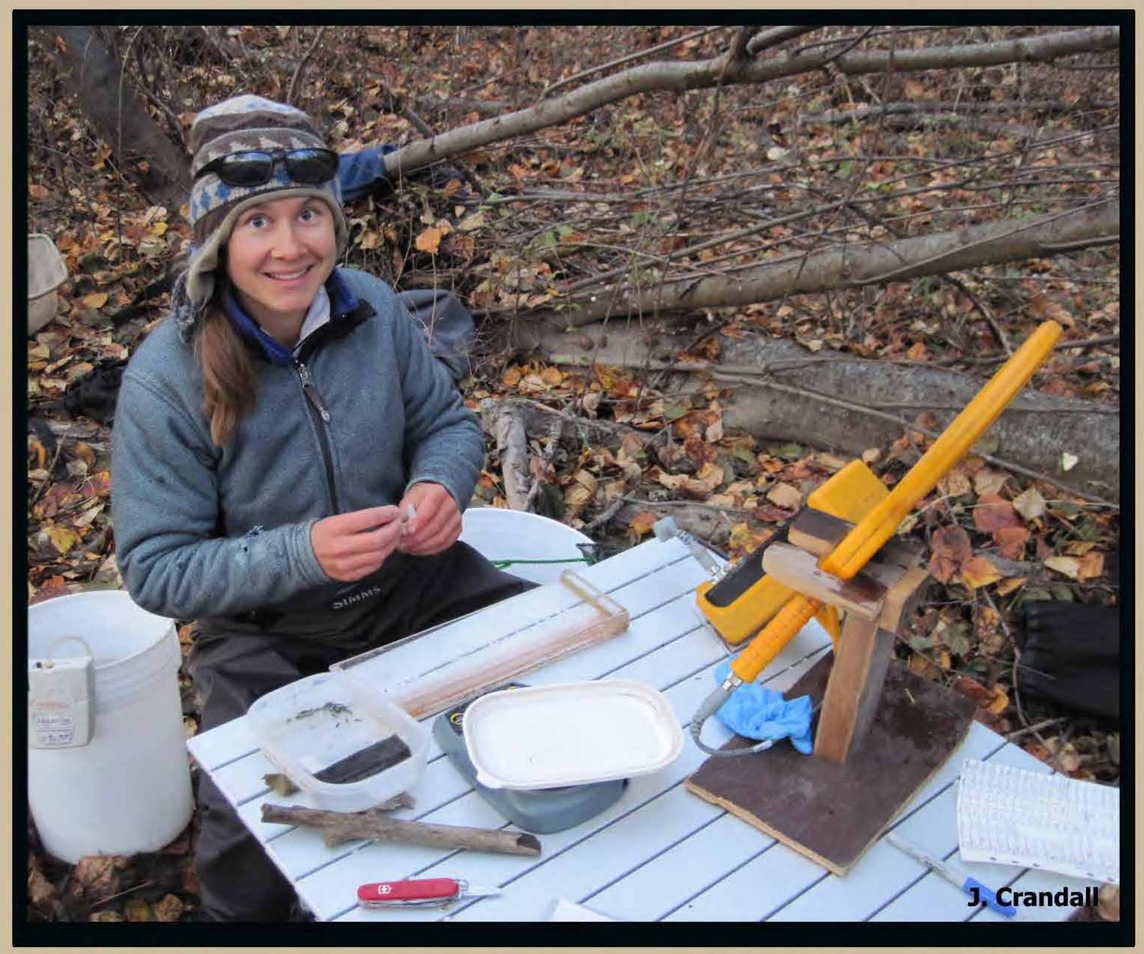
To date, several thousand logs have been installed in the Methow at over twenty locations. Monitoring of these structures reveals extensive fish use by a variety of species including Chinook and coho salmon and steelhead. Juvenile fish, generally less than 5" (<130mm) in length, appear to be especially attracted to the structures where they are able to inhabit the small, tight spaces within the interior of the structure for feeding and safety.

Top- Engineered wood structure as viewed from the surface. Bottom- A view below the water surface showing juvenile salmon using an engineered wood structure.

Local Monitoring Efforts

Monitoring fish populations and habitat conditions in the Methow is critical to understanding the status and trends of the fish and their habitat. Monitoring is also used to gauge the effectiveness of the various habitat restoration projects at meeting their goals of improving conditions for fish. Under guidance provided by the Upper Columbia Salmon Recovery Plan, the Methow Restoration Council facilitates the coordination of several fish and habitat monitoring programs that have been on-going in the Methow for over a decade. Monitoring activities are conducted by over a dozen agencies, tribes, and non-profit organizations. Combined, this effort examines a suite of biological and physical variables that can provide information of how fish and their habitat are fairing over time.

The monitoring effort in the Methow is diverse and extensive. It is responsible for tracking the number of adult salmon returning to the Methow to spawn and the number of smolts produced by these spawners. Fish growth and movement are assessed by inserting coded tags into fish. Water quality, stream discharge, habitat conditions, and water temperature are all monitored to track changes in the environmental parameters on which fish depend. For more information, contact John Crandall, Methow Monitoring Coordinator, at john@methowsalmon.org.



A local biologist prepares to tag and inventory young salmonids to track their growth and survival.

The Methow Watershed

The Methow River watershed is located in Okanogan County in north-central Washington along the eastern slope of the North Cascades mountain range. The south-easterly flowing Methow River travels for over 80 miles and drains an approximate 1,800 square mile (1.1. million acre) watershed into the Columbia River near Pateros.

The headwaters of the Methow watershed originate at elevations in excess of 8,000' (2438m) in mountainous alpine and subalpine terrain. The river flows through coniferous and riparian forestlands down to an elevation of approximately 2,500' (762m) where shrub steppe and ponderosa pine communities dominate the landscape downstream to the confluence with the Columbia River at an elevation of 775'. (236m). Generally, the western half of the watershed is higher elevation and wetter compared to the drier eastern half.

For the purposes of describing fish distribution throughout this guide, the watershed is divided into five subbasins: the Upper Methow River, Chewuch River, Middle Methow River, Twisp River and Lower Methow River. An additional area, the Impoundment Zone, is also included and refers to the lowest mile of the Methow River that lies under the reservoir elevation at the confluence with Wells Reservoir. A map is provided on page 4.

Upper Methow- The upper Methow subbasin is the largest in the Methow watershed comprising nearly 480,000 acres and nearly 40% of total watershed area. It includes the Methow River headwaters downstream to the Goat Creek confluence. This subbasin originates in glacial-formed cirques and valleys that drop steeply down to more alluvial and meandering reaches on the valley floors.

Major tributaries- Lost River, Early Winters Creek, Robinson Creek, Goat Creek

Chewuch River- The Chewuch River subbasin is the second largest in the Methow watershed encompassing over 340,000 acres. The Chewuch originates in the north-eastern section of the watershed and flows for over 44 miles from its origin to its confluence with the Methow River in Winthrop. A natural barrier to fish passage exists above Thirtymile Creek. Chewuch is a native word for "creek".

Major tributaries- Andrews Creek, Lake Creek, Twentymile Creek, Eightmile Creek, Cub Creek, Boulder Creek

Twisp River- The Twisp River subbasin lies along the western boundary of the watershed and flows 28 miles in an easterly direction from its headwaters in the Lake Chelan Sawtooth Wilderness down to its confluence with the Methow River in Twisp. It is the third largest subbasin and encompasses nearly 15% of the Methow watershed area. Twisp is a native word for "wasp".

Major tributaries- North Creek, South Creek, War Creek, Buttermilk Creek, Little Bridge Creek, Poorman Creek

Middle Methow- The middle Methow subbasin encompasses over 35 miles of stream from Goat Creek to Carlton. The Methow River in this reach is valley bottom and low gradient with associated floodplains and side channels. This reach has undergone the most human-related development in the watershed and so is the focus of a coordinated habitat restoration program aimed at improving habitat conditions for fish.

Major tributaries- Fawn Creek, Hancock Springs, Wolf Creek, Beaver Creek, Bear Creek

Lower Methow- The lower Methow River is the most downstream subbasin in the watershed and includes the lower 27 miles of stream culminating at its confluence with the Columbia River (Wells Reservoir) at Pateros. This subbasin includes high elevation mountains in the western portion and dryer lowlands to the east of the Methow River. In total, this subbasin encompasses over 200,000 acres.

Major tributaries – Libby Creek, Gold Creek, Black Canyon Creek

Impoundment Zone- The lowest mile of the Methow River is backwatered by Wells Dam and functions as more of a lake than a river. As such, the aquatic habitat and water quality differ significantly from the river upstream. This provides habitat for a different fish community than would otherwise be in the river, including native species, like chiselmouth and peamouth, as well as non-native warm-water species, such as largemouth bass, walleye, and carp.

An aerial view of the Methow River between Twisp and Winthrop.

Methow Watershed Fish Distribution Chart

The chart below represents the most current distribution knowledge for species covered in this guide. The subbasins correspond to those detailed on the map on page 4.

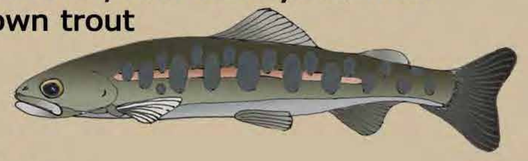
Key
=Present
=Possible/Occasional
= Unlikely

	Upper Methow River	Chewuch River	Middle Methow River	Twisp River	Lower Methow River	Impoundment
Native Species						
Chinook Salmon						
Coho Salmon						
Sockeye Salmon						
Steelhead/Redband Trout						
Bull Trout						
W. Slope Cutthroat Trout						
Mt. Whitefish						
Redside Shiner						
Longnose Dace						
Speckled Dace						
Pikeminnow						
Chiselmouth						
Peamouth						
Stickelback						
Mottled Sculpin						
Paiute Sculpin						
Prickly Sculpin						
Shorthead Sculpin						
Torrent Sculpin						
Bridgelip Sucker						
Largescale Sucker						
Pacific Lamprey						
Western Brook Lamprey						
Introduced Species						
Brook Trout						
Brown trout						
Common Carp						
Brown Bullhead						
Largemouth Bass						
Smallmouth Bass						
Walleye						
Yellow Perch						

Family Level Identifiers

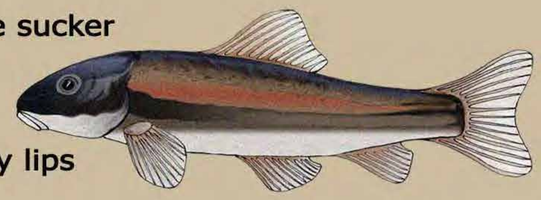
Similar fish species are organized into groups called families. Characteristics of the fish families found in the Methow are listed below. More detail on individual species can be found on later pages. When identifying fish pay close attention to overall body shape and location of fins. (See diagram on p.19 for fish anatomy definitions).

Salmon Family (*Salmonidae*)
Native species: mountain whitefish, bull trout, cutthroat trout, rainbow trout/steelhead, Chinook salmon, coho salmon, and sockeye salmon
Introduced species: brook trout and brown trout
Family level identifiers :



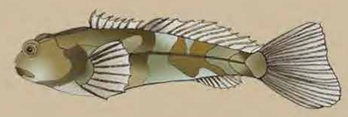
- Adipose fin
- Rayed fins lacking spines
- Narrow body shape with forked tail
- Pelvic fins set towards abdominal region
- Parr marks visible on young fish

Sucker Family (*Catostomidae*)
Native species: bridgelip and largescale sucker
Family level identifiers:



- Large visible scales
- Thick bellied
- Subterminal mouth with thick fleshy lips

Sculpin Family (*Cottidae*)
Native species: several sculpin
Family level identifiers:



- Large head and mouth
- Large fan-like pectoral fins
- Lack of scales on body
- Body shape is dorsally depressed

Minnow Family (*Cyprinidae*)
Native species: chiselmouth, peamouth, various dace, northern pikeminnow, and redside shiner
Introduced species: common carp
Family level identifiers:

- Elongate to moderately deep body shape
- Single dorsal fin with < nine rays
- Fins typically flexible and soft

Stickleback Family (*Gasterosteidae*)
Native species: Three-spined stickleback
Family level identifiers:

- Pronounced spines in dorsal fin
- Broad caudal fin in relation to body size
- Large bony plates not scales on flanks
- Torpedo shaped body

Lamprey Family (*Petromyzontidae*)
Native species: Pacific lamprey, western brook lamprey
Family Level Identifiers:

- Long eel shaped body
- Larvae lack eyes and mouth
- Rounded disk shaped mouth with small teeth

Fish Handling Guidelines

It is important to remember that several fish species found in the Methow River basin are listed as endangered or threatened under the Federal Endangered Species Act. Steelhead, spring Chinook salmon, and bull trout are listed species and therefore protected. Other species such as westslope cutthroat trout, have declined in parts of their historic range and therefore are catch and release only in the Methow.

A wild Methow River steelhead is handled carefully after being caught and prior to release.

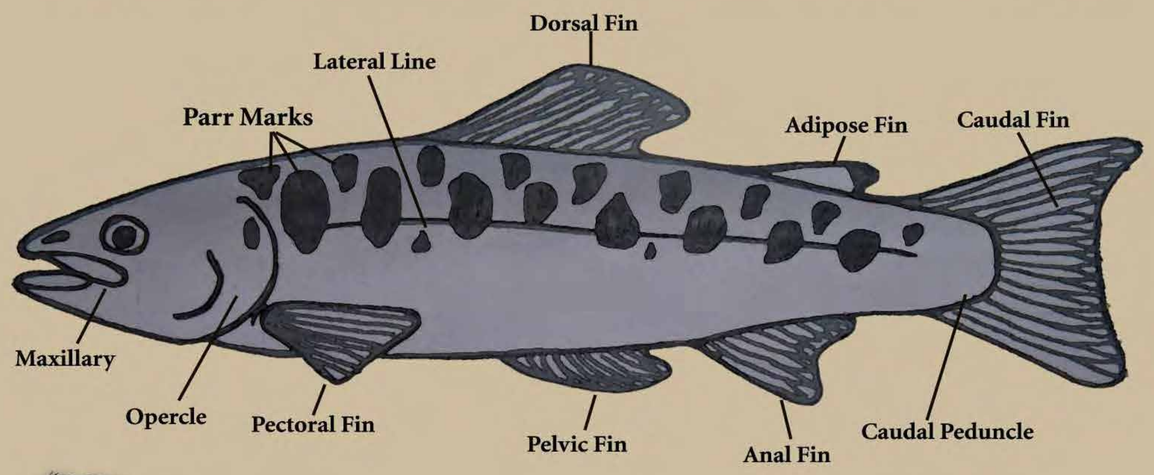
Great care should always be used when handling fish, as most are highly sensitive and can be unintentionally injured or killed by improper treatment. Be aware of Washington State fishing regulations and guidelines (www.wdfw.wa.gov) and know that these can change from year to year.

When handling fish, practice the following techniques to minimize harm:

- Keep fish in the water at all times, wet your hands before touching fish, and minimize handling time.
- Keep fingers out of the gills, mouth, and eyes.
- If a fish has swallowed your hook, best to cut the leader.
- Use only soft, knotless nets, rubber meshed are best.

Fish Anatomy

The diagram below shows general fish anatomy features referenced in this guide.



Salmonid Fry Pictures

Below are pictures of six native salmonid fry found in the Methow basin, along with notes on identifying features used to help tell them apart. More detailed descriptions of each species are found starting on page 21. Salmonid fry are very sensitive and great care should be used when observing them to avoid harm.

Mountain Whitefish
-Sub-terminal mouth
-Light colored
-Absence of pigment in fins
-Small parr marks

Steelhead/Redband trout
-Black leading edge on dorsal fin
-Adipose fin is mostly clear with a ring of pigment

Westslope Cutthroat Trout
-Very similar to O. mykiss and hard to distinguish between fry of the two species

Bull Trout
-Irregular parr marks
-Darker colorings and spots over most of body

Chinook Salmon
-White tip and dark leading edge to dorsal fin
-Clear adipose fin
-Parr marks wide and tightly spaced

Coho Salmon
-Anal and dorsal fins have white leading edge
-Caudal, adipose, and anal fins have orange tint
-Anal fin is sickle-shaped

All photos J. Crandall

Mountain Whitefish *Prosopium williamsoni*

Mountain whitefish are the most common salmonid found in the Methow and other Columbia River tributaries. At first glance, mountain whitefish may appear similar to suckers, but closer inspection can help distinguish them from these and other species.

Identifying Features

Fry and Parr
- **Juveniles have light-gray to brown coloring with circular, dark parr marks**
- **Blunt, rounded head compared to other salmonid fry**

Adult
- **Rounded body form**
- **Small, toothless mouth with over-hanging upper snout**
- **Short dorsal fin with 12-13 rays**
- **Adults are silver-brown to gold with some subtle blue tints**
- **Visible scales**
- **Large adipose fin**
- **Deeply forked tail**

Adult Size Range
- **Average length 12-20" (30-50 cm)**
- **Average adult weight 1-2 lbs. (1 kg)**

Top- Closeup of adult mouth. Below- Juvenile whitefish displaying prominent parr marks.

An adult Methow River whitefish feeding over cobble substrate.

Life History and Ecology

Mountain whitefish generally spawn from late fall into winter, when water temperatures are 2-6 °C (36-43 °F). They are broadcast spawners, releasing many small eggs over an area of coarse gravel or cobble. The eggs sink into the interstitial spaces between rocks where they incubate for 6-10 weeks. Whitefish fry usually emerge in early spring depending on spawning time. Adults may spawn multiple times during their life. Average life span for whitefish is 8-9 years with the oldest recorded whitefish being 18 years. Sexual maturity is reached between 3 and 4 years.

In some areas, mountain whitefish make short seasonal migrations between primary feeding grounds (that are inhabited for most of the year) and spawning grounds. Fall migrations from the mainstem Methow into the Upper Methow, Chewuch, and Twisp rivers and even into the lower portions of the Okanogan River occur.

Whitefish are primarily bottom feeders, utilizing their tails and pectoral fins to agitate the substrate and expose potential food while their downward-oriented mouth vacuums it up. They consume aquatic insects including midges and caddisfly larvae. Other foods include: fish eggs, mollusks, crustaceans, snails, algae, and detritus. Though mainly bottoms feeders, they will occasionally eat hatching insects on the surface of pools or other slow water habitats. They feed during both day and night.

Whitefish were an important food source for some Northwest Native Americans. Though some anglers consider them less desirable than other salmonids, they are still pursued as a sport fish today with a regulated winter fishing season in the Methow.

Habitat Characteristics

Adult mountain whitefish prefer pools or deeper runs and riffles, often schooling just off the bottom. They favor cold, clean waters, but can tolerate warmer temperatures more readily than other native salmonids. Adults are less likely to utilize log jams, undercut banks, or similar structure than other salmonids. Fry often group with young steelhead in the shallow, warmer margins of larger streams and pool and run tailouts. As noted above, whitefish may migrate seasonally and utilize different habitat types at different times of the year.

Within the Methow they are found throughout the mainstem and larger tributaries including the Chewuch and Twisp Rivers. Spawning areas are not well documented.

An adult mountain whitefish displaying characteristic golden flanks.

Bull Trout *Salvelinus confluentus*

Bull trout are members of the genus *Salvelinus* making them the only native species of char found in the Methow watershed. They are very sensitive to water temperature, preferring cold and clean waters. Their presence is an indicator of good water quality.

Identifying Features

Fry
- **Irregular parr mark shape and distribution**
- **Clear fins with no spotting**
- **Some dark pigment on leading edge of dorsal fin**

Juveniles
- **Orange, red, yellow, and some white spotting contrasted to dark gray-green body (light spots on dark background)**
- **More dark pigment than light along midline**
- **Parr marks faded**

Adult
- **White leading edge on lower fins**
- **Caudal fin lacks deep forking and has a squared off shape**
- **Overall shape is slender in contrast to other salmonids**
- **Males typically display more vibrant coloring than females**

Adult size range
- **Migrant 18-35" (40-85 cm)**
- **Resident- 8-12" (20-30 cm)**

Top-Adult male displaying pronounced kype. Above- Bull trout fry with irregular parr marks. Below-Adult bull trout showing white leading edge on lower fins and light-colored spotting on dark background.

Adult bull trout from the mainstem Methow River.

Life History and Ecology

Bull trout in the Methow may exhibit resident, fluvial, or adfluvial life histories. Resident bull trout spend their entire life in small headwater streams and often may be isolated from other populations by impassible barriers. Fluvial individuals will move between the mainstem and smaller tributaries of the Methow River, utilizing tributary waters for spawning and rearing and larger waters for feeding and growth. Adfluvial populations move between lakes and their tributaries. Adfluvial bull trout will spawn and rear in small tributaries and use lakes, including Wells Reservoir, for feeding and growth.

Sexual maturation occurs at 3-4 years of age for resident forms, and closer to 4-6 years for adfluvial and fluvial forms. Bull trout require spawning areas with gravel substrates, a cold water tributary or spring nearby, and overhanging vegetation or other protective cover. They migrate towards preferred spawning grounds in early June, begin spawning in early September, with fry beginning to emerge the following March. Non-resident forms will leave rearing habitat at 2-3 years old, moving into larger waters for better feeding opportunities.

Young bull trout feed primarily on midges, mayflies, and other aquatic insects. Not until they reach larger size, typically over 20 cm (8 inches), will they incorporate fish, frogs, and additional larger prey into their diet. Bull trout are widely known for being piscivores, or predators of other fish species including sculpin, dace, and other young salmonids.

The introduction of brook trout to the Methow basin has created the possibility of bull x brook hybrids, which are difficult to distinguish from pure bull trout or brook trout. Hybrids may some times be identified by dark spotting on their dorsal and caudal fins, dorsal vermiculations, and a mix of black and white on the leading edge of lower fins. Hybridization is one of several threats to the viability of healthy bull trout populations in the Methow and elsewhere.

Other threats to bull trout survival include loss of habitat, warming of waters from loss of riparian forests, and over fishing. Bull trout are often cited as an indicator species for overall riverine ecosystem health due to their sensitivity to warm water and other stream modifications. In areas where grazing, logging, and road building have been poorly managed, bull trout populations demonstrate a clear negative response to associated degradation of their aquatic habitat. Declines of local bull trout populations have resulted in listing under the Federal Endangered Species Act as "Threatened ".

Habitat Characteristics

Distribution of bull trout within the Methow basin is widespread and varies seasonally primarily in response to temperature and reproductive cycles. Optimum temperature range for bull trout is between 42-54ºF (5-12ºC). In warmer months they will move to upper tributaries or deeper pools of the mainstem. As temperatures cool they can be found throughout the system.

Westslope Cutthroat Trout *Oncorhyncus clarki lewisi*

Westslope cutthroat are one of several subspecies of cutthroat trout native to the Pacific Northwest. The name "cutthroat" originates from a defined red-orange slash below the jaw on adult fish. Where cutthroats co-exist with rainbow trout, hybrids sharing similar features may occur, confusing identification between the two species.

Identifying Features

Fry to Parr
- **Black leading edge on dorsal**
- **Parr marks primarily along lateral line region**
- **Dorsal has white tip on three or fewer rays**
- **Very similar in appearance to *O. mykiss***

Parr to Adult
- **Maxillary extends past rear margin of eye on fish > 8 cm**
- **Fish over 10 cm have red to orange slash mark below jaw**
- **Males develop red to pinkish blush on opercule and flanks**
- **Caudal fin spotting in line with rays**
- **Spotting on body and head heavier above lateral line and towards tail region (dark spots on light body)**

Adult Size Range
- **Small tributary stream residents 6-12" (15-30 cm)**
- **Larger tributaries and mainstem residents 12-25" (30-52 cm)**

Above- Adult resident westslope cutthroat displays orange and pink blush on flanks and gill plate.

Above- A resident cutthroat shows typical spotting patterns and red blush on opercle. Below-Large Methow adult, note colors of gill plate, flanks, and slash on jaw.

Life History and Ecology

Within the Methow watershed, westslope cutthroat may occur as a resident form that lives in small streams its entire life, as a fluvial variety that lives mainly in larger tributaries or the mainstem, as an adfluvial variety that move in and out of the Columbia River, or as lake residents in higher elevation lakes. Most cutthroat populations found in high elevation lakes were imported by stocking programs for recreational fishing.

All three stream dwelling forms will spawn during spring. Sexual maturity for westslope cutthroat occurs between 3 and 5 years, and they are capable of repeat spawning. Average life span for residents of smaller streams is 3-4 years with a maximum of 7-8 years. Cutthroat inhabiting larger tributaries have a life span range of 6-8 years with some individuals reaching 12-13 years and growing to 8-9 pounds (3.5-4.5 kilos).

Though other species of cutthroat often demonstrate predatory feeding behavior on fish, westslope cutthroat primarily eat insects. Main foods include caddisflies, stoneflies, mayflies, and other aquatic insects. Terrestrial insects including flying ants, grasshoppers, beetles, and water mites. This may be an evolutionary niche derived from existing in waters shared with bull trout and northern pikeminnow, both aggressive piscivores.

Overall population numbers, distribution, and genetic purity of native westslope cutthroat have all been impacted by stocking of non-native cutthroat variants, Eastern brook trout, and hybridization with *O. mykiss*. Historic cutthroat stocking programs in mountain lakes expanded distribution and allowed fish to drift downstream into previously uninhabited streams.

In the early 1900s over six million Yellowstone cutthroat trout eggs were sent to Washington state. Many of these eggs were distributed in Eastern Washington, including roughly 200,000 in rivers within Okanogan County. Such activities have resulted in a decrease of genetic purity in the native stocks of westslope cutthroat within the Methow basin and throughout other regions of the Upper Columbia Basin. In areas where hybridization with *O. mykiss* is present competition for food and space may occur.

Habitat Characteristics

Like other salmonids, cutthroat prefer clear, cold waters with abundant cover such as undercut banks, log jams, and large rock features. They thrive in waters with diverse habitat types with a mix of pools and riffles. They can be found higher up in small tributaries, including areas above barriers to other fish. They will use intermittent tributaries and other off-channel habitat. During spawning they will seek riffles and pool crests with coarse gravel substrates.

They can be found throughout the Methow basin, from high mountain lakes that feed into small tributaries to the lower reaches of the mainstem with healthy populations often in areas with minimal human disturbance.

Steelhead/Rainbow Trout *Oncorhynchus mykiss*

Steelhead and rainbow trout are two variants of the same species that exhibit different life histories. The local native subspecies of *Oncorhynchus mykiss* is known as the Inland Columbia River "redband" trout. In this guide redband refers to the local resident and steelhead is used for *O. mykiss* with an anadromous life history.

Identifying Features

Fry
- **White "flag" on dorsal fin**
- **Red striping along lateral line**
- **Little or no break in black colored edge around a clear adipose**
- **Parr marks along lateral line**
- **Black leading edge on dorsal fin**
- **Light black spotting on caudal fin**

Parr
- **Maxillary ends at or before rear margin of eye**
- **Approximately 5 parr-like marks on dorsal region**
- **Red stripe along lateral line is more obvious**
- **White tips on anal and pelvic fins**

Adult Steelhead Only
- **Silvery sheen with intense red hues along lateral line**
- **Kyped lower jaw in some males**

Adult Size Range
- **Redband 8-22" (20-56 cm)**
- **Steelhead 28-40" (72-85 cm)**

An adult resident redband shows red coloring on opercle, parr marks, dark spots, and lateral red stripe.

Above- A steelhead fry showing parr marks and black leading edge on dorsal fin.

An adult redband trout displaying dark spots on a light background and predominant red striping.

Life History and Ecology

Redband trout and steelhead are widespread in the Methow basin. They occur as resident, fluvial, adfluvial, and anadromous variants. Redband typically live from 4-6 years but may live as long as 9-12 years. Current wild steelhead populations in the Methow are estimated at less than 10% of their historical numbers with the bulk of today's population consisting of hatchery raised fish. According to state records, an average of 322,015 winter and summer steelhead smolts a year, were released into the Methow River and its tributaries from 2007 to 2016. Data from the Fish Passage Center (http://www.fpc.org) shows the five year average for returning adult steelhead passing through Wells Dam from 2011-2016 was 7,744 for hatchery fish and 3,348 for wild fish. These numbers mark a significant decline from the previous 5 year (2007-2011) average of 13,516 for hatchery and 4,638 for wild fish. Fish from this count were potentially headed for the Okanogan River or the Methow River.

Methow steelhead enter the Columbia River from the ocean in summer and are thus considered summer steelhead. Hatchery raised steelhead often reach smolt size (6-8" /15-21 cm) faster than wild varieties and will migrate to sea at an earlier age. Steelhead typically begin spawning in mid-March in lower reaches of the mainstem and roughly a month later in the upper mainstem and tributaries. Fry emerge in early July and spend the next 2-3 years rearing to smolt size.

Smolts usually begin their journey to sea in late April and May, following high spring flows downstream. In 20-30 days they will reach the Columbia River estuary where they spend several weeks preparing for life in the ocean. They spend between 1-3 years at sea before migrating back up the Columbia to reach Methow spawning grounds. During migration, they must pass through nine dams in each direction. Unlike other anadromous salmonids, not all steelhead die after spawning and some fish, known as kelts, may repeat spawn. Today, kelts in the Methow River are rare.

Primary food for resident fry and parr includes zooplankton, small insects, and chironomid larvae. Adults may consume mayflies, caddisflies, stoneflies, grasshoppers, wasps, dragonflies, aphids, other bugs, and occasionally crayfish and other small fish. Steelhead will eat more fish while at sea and will continue feeding as they migrate towards spawning grounds.

Habitat Characteristics

Redband may be found within the Methow drainage in all sizes of streams and rivers. Small fish often hide in stream margins amongst log jams and undercut banks. In faster waters they occupy riffle crest or pockets of slow water behind large rocks. Adults will inhabit areas with larger more turbulent flows in bigger tributaries or the mainstem, and prefer areas with coarse gravel or rocky substrates.

Returning adult steelhead will often hold in large pools in lower reaches of the mainstem, awaiting warmer temperatures and increased flows to move up river. Like other salmonids, they require cold, clean waters for their survival and prefer water temperatures that range from 48-54 ºF (9 to 12º C).

Chinook Salmon *Oncorhynchus tshawytscha*

Chinook salmon (also called "king") are the largest and most numerous salmon species in the Methow River with adults reaching weights over 40 pounds (18kg). There are two runs, spring and summer, and the spring run is listed as endangered. Similar size chinook and coho require close examination to differentiate between the two species.

Identifying Features

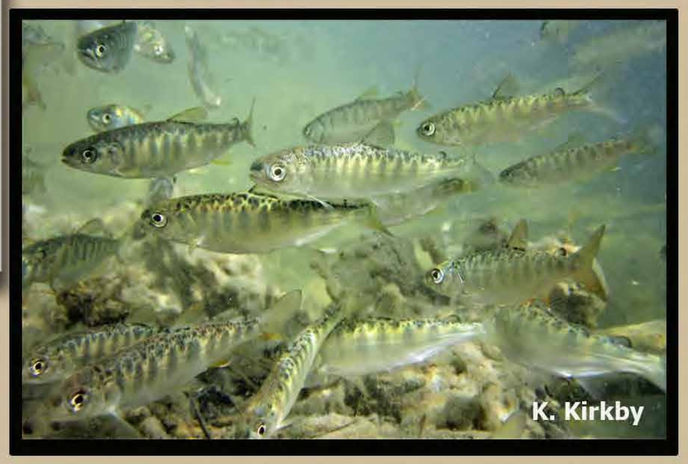
Parr
- **White tip and dark leading edge on dorsal fin**
- **Adipose fin has dark leading edge and clear interior**
- **Anal fin with straight edges and white leading edge**
- **Chinook have wider, closer, spaced parr marks compared to coho**

Smolt
- **Dark dorsal region**
- **Bright silver sides**
- **Parr marks faded**

Adults
- **Black mouth and gum line**
- **Spotting along dorsal region and lobes of caudal fin**
- **Narrow caudal peduncle**
- **Smooth caudal fin rays**
- **Adult chinook are typically larger than adult coho**
- **Spawning males have red hues on flanks and kyped jaws**

Size Range
- **Parr 2-6" (50-150mm)**
- **Adult 30-36" (80-90cm)**
- **Jacks 16-22" (40-58cm)**

Top-Parr stage Chinook. Above- Adult Chinook holding in a tributary of the Methow River preparing to spawn. Below- A school of Chinook parr in the Methow River.



Life History and Ecology

Both spring and summer "runs" of chinook inhabit the Methow River, and fry from both types emerge from gravel substrates in early to mid-March. Summer chinook are known as "ocean type" and smolts migrate to sea before reaching age one. Spring chinook are known as "stream-type" and spend over a year in freshwater prior to smolting.

Extended time in freshwater allows spring-run smolts to reach a larger size than summer run smolts before entering saltwater. Smolts of both runs begin the trip to sea from late April to early May or in the fall. In addition to changes in physical appearance, smolts undergo physiological changes in preparation for the transition to saltwater environments.

During their out-migration, smolts must pass through nine hydroelectric dams and their impoundments, and numerous native and exotic predator fish species that thrive in the reservoirs. They will spend anywhere from 1 to 4 years at sea traveling hundreds of miles in search of herring, anchovies, needlefish, and other food sources.

Several different life histories are possible for male chinook, with each reaching sexual maturity at a different age. A small percentage of males never leave freshwater, becoming sexually mature at age two. These smaller fish are known as precocial males and typically reach 8-12" long. Another male variant, called a "jack", spends about a year at sea before returning ready to spawn. Jacks range from 16-22" long. Both precocial males and jacks may compete with full size adults for spawning opportunities.

Adults begin the return trip home in late winter, reaching the Methow from mid-May to early June. Spring chinook enter the river first, with summers arriving later. Spring chinook typically spawn from mid-August to late September while summers spawn from October to November. Females excavate a redd where they may deposit 3,000-6,500 eggs. Their eggs are the largest of all salmon species and require streams with good sub-gravel water flows and high dissolved oxygen levels for development and survival. Chinook salmon die after spawning.

Juvenile chinook initially feed mainly on plankton, adding midges, mayflies, and other insects as they grow. Migrating smolts will spend time in the Columbia River estuary adapting to saltwater, feeding on crab larvae, small fish, and insects.

Habitat Characteristics

Chinook require cold, clean waters with high dissolved oxygen levels and a temperature range between 42-52º F (5-10ºC). Water temperatures above 64ºF (18ºC) can have sub-lethal effects with continued temperatures above 70ºF (21ºC) being lethal.

Adults use deep pools, log jams, undercut banks, and boulders, as "holding habitat" as shelter while waiting to spawn. Chinook require coarse gravel substrates with minimal sedimentation for building redds. Parr rear in larger tributaries and portions of the mainstem with woody debris and other overhead and instream cover. They establish feeding territories and readily defend these from other parr.

Spawning areas for summer run fish include the mainstem from the mouth to Winthrop. Spring chinook spawning areas include upper portions of the mainstem above Winthrop, and the Twisp, Lost, and Chewuch Rivers.

Coho Salmon *Oncorhynchus kisutch*

Coho or "silver" salmon were once the most numerous salmon species in the Methow River. Wild stocks of coho were extirpated from the Methow River in the early 20th century after the construction of a dam at Pateros. Coho recently have returned to the Methow River as a result of reintroduction efforts by the Yakama Nation.

Identifying Features

Fry and Parr
- **Sickle shaped anal fin**
- **Dorsal and anal fins have white leading edge with black behind**
- **Orange hue to the tail, pectoral, and pelvic fins**
- **Larger spaces between parr marks compared to chinook**

Adult
- **Black coloring around mouth with distinctive white gum line**
- **Spotting only along top edge of caudal fin**
- **Males have pronounced kyping of jaws**
- **Wide caudal peduncle**
- **Spawning males and females show red to maroon colors on flanks, with dark blue-green hues above lateral line**

Adult Size Range
- **Average 24-28" (61-70 cm)**
- **Weight 6-9.5 lb (2.7- 4.3 kg)**

Above- A stream bank provides cover for spawning Coho in a Methow tributary. Below-Two adult coho on a redd showing the scars of migration and spawning.

An adult coho showing kyped jaw,white gum line, and minimal spotting on caudal fin.

Life History and Ecology

Coho salmon in the interior Columbia River system return from the ocean at three years of age to spawn in tributaries during October through November. Eggs hatch the following spring and young fish spend around 18 months rearing in tributaries. Juvenile coho migrate to sea as smolts where they feed and grow to adult size before returning to natal spawning grounds to repeat the cycle. Female coho may dig as many as 3-4 redds, will spawn with multiple males, and can produce between 2,200-2,900 eggs. Adult coho die after spawning.

Some mature males will return to spawning grounds at an early age, usually two years old, and will compete for spawning females with older males. Known as jacks, their numbers are used to predict the numbers for the next run of three year old fish.

Young coho prey upon many types of invertebrates, including caddisfly, stonefly, and mayfly larvae. As they increase in size, juvenile coho will prey on other small fish such as sculpins and young salmonids. In the ocean, adult coho feed on a variety of fish including herring, smelt, anchovies, and needlefish.

Habitat Characteristics

Although they will use most types of stream habitats, young coho spend much of their time in off-channel habitat including beaver ponds, sloughs, side channels, and other slow water. During colder periods of the year they will often retreat to undercut banks, debris jams, or other complex structures. In smaller streams they often occupy pools or other slow water habitats.

Efforts by the Yakama Nation to reintroduce coho to the Methow River are helping bring the species back to portions of its former range. Using a combination of hatcheries and acclimation ponds that simulate natural habitat, young fish establish the Methow as their home. After being absent from the basin for nearly one hundred years, coho are making a strong comeback. In addition to the hatchery-based population, coho are beginning to spawn on their own in parts of the Methow River.

A coho parr showing sickle shaped anal fin and orange hues on tail and lower fins.

Sockeye Salmon *Oncorhynchus nerka*

Sockeye salmon occur within the Methow Basin primarily as adult strays from the Okanogan River and a larger self-sustaining population for the species is limited by a lack of a natal lake for juvenile rearing.

Identifying Features

Fry and Parr
- **Silver-green body color**
- **Parr marks variable in length**
- **Adipose fin lacks pigment**

Adult Males
- **Bright red body with green head and tail**
- **Large kyped jaws with visible teeth**
- **Well developed hump between head and dorsal region**
- **Black coloring of tongue and along gum region**
- **No spots on caudal fin**

Adult Females
- **Similar red and green coloring**
- **Lacks visible dorsal hump**
- **No kyped jaw**

Adult Size Range
- **Average 21-26" (53-66 cm)**
- **Weight 4-7 lb (1.8-3.2kg)**
- **Adults are generally smaller than chinook and coho adults.**

Above- Sockeye fry showing large eye to head ratio and irregular parr marks. Below- An adult male sockeye showing kyped jaw and black coloring around mouth and snout.

An adult male sockeye showing spawning colors and dorsal hump.

Life History and Ecology

Sockeye salmon typically spawn in early to mid fall in streams that are connected to lakes. Females will create multiple redds where they deposit from 2,000-4,000 eggs. Alevins emerge from the substrate in late winter to early spring and quickly migrate upstream or downstream into the adjacent lake. Fry usually spend 1-2 years rearing in the lake habitat feeding on plankton and aquatic insects as they prepare to make their downstream migration to the Pacific Ocean.

Sockeye smolts head downstream in late spring and move into estuaries and other near-shore ocean zones. They spend several months feeding on insects and plankton before moving into deeper ocean waters to feed on squid, copepods, amphipods, and other small fish such as sand lance. Adults will usually spend two years at sea before making the return trip up the Columbia River to their natal spawning grounds.

The Methow River has no suitable lakes for rearing and sockeye that stray into the system lack ideal habitat to establish a successful population. The creation of the impoundment zone behind Wells Dam may serve as artificial rearing habitat where young sockeye born in the Methow Basin may successfully reach smolt stage. Local fisheries professionals have encountered sockeye fry in the river, but no studies have confirmed the existence of a self-sustaining sockeye population in the Methow Basin.

It is likely that most adult sockeye found in the Methow River are strays from either the Okanogan or Wenatchee Basins where established populations of sockeye have existed naturally for thousands of years.

Habitat Characteristics

Sockeye will utilize a diverse range of aquatic habitats over the course of their life, found within a variety of stream and lake habitat combinations. Like other salmonids found in the Methow basin, they require shallow riffles with clean cobble and gravel substrate for spawning. They will also spawn in shallows around the edges of a connected lake if suitable waterflows and substrates are available.

Their requirement of lake habitat for rearing is a result of the fry having a diet high in plankton which proliferate in lakes. Fry will initially spend time in shallow waters of the lake, gradually moving into the deeper zones.

Sockeye have also adapted to living in lakes with no ocean access. Landlocked sockeye, called kokanee, spend most of their time living in a lake, using feeder streams for spawning. Kokanee are typically smaller than anadromous sockeye.

A spawning female (front) and male sockeye hold over a constructed redd in the Methow River.

Redside Shiner *Richardsonius balteatus*

Redside shiners are a member of the minnow family (Cyprinidae). Their distribution has not been fully established in the Methow drainage, but their preference for slow water zones makes the impoundment area at the mouth of the Methow as well as in the lower Methow likely as primary habitats.

Identifying Features

- **Light lateral stripe above wide, dark band along length of body**
- **Large eye**
- **Dark gray-green to brown color on back with slivery underside**
- **Deeply forked caudal fin**
- **Snout-like mouth extends almost to front margin of eye**
- **Long anal fin with typically >13 rays**
- **Dorsal fin set to rear of body**
- **Males have bright gold to red coloring on sides and small nuptial tubercles (bumps) on heads during spawning**
- **Females are pale gray to green color during spawning**

Adult Size Range

- **Average 2-3" (5-7 cm) but may grow up to 7" (18 cm)**

Above- Male shiner top and female bottom. Below- A close up of a male shiner in the lower Methow River.

Above- Redside shiners often school together in slow water habitats including here in the Lower Methow.

Life History and Ecology

Sexual maturity in redside shiners is typically reached between 2-3 years old. Although specific data for the Methow is limited, spawning in other Columbia river tributaries usually occurs between late May and mid July. Like other minnow species, their preferred spawning habitat is shallow water with coarse gravel or cobble substrates. Multiple males will surround a single female and fertilize her eggs as they are broadcast over an area. The sticky eggs drift to the bottom where they adhere to plants, detritus, and rocky substrates. Females may release from 1,500-3,000 eggs during spawning. Eggs may mature in as little as 2 weeks time. Maximum life span for shiners is 3-4 years.

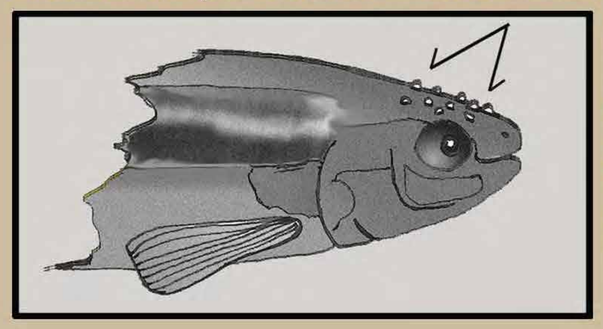
Young shiners feed primarily on small planktonic organisms and algae. As they mature, they add aquatic and terrestrial insects, small mollusks, fish eggs, and the occasional small fish to their diet. The shiner's small size and lack of spiny rays makes them a good forage fish for larger fish, herons, mergansers, kingfishers, and water snakes. Like other minnows, they are commonly found in large schools and rarely seen as individuals. They may hybridize with other cyprinid species including pikeminnows and dace.

Though native to the Columbia River and many of its tributaries, redside shiners were introduced to other bodies of water as a potential food source for game fish and as bait fish. Due to their ability for rapid reproduction, they often end up being more of a competitor for food and as such a nuisance fish. Resource managers in some areas of the Pacific Northwest are trying to eradicate them from areas where they were introduced.

Habitat Characteristics

Redside shiners can be found in the larger waters of the Methow basin, where deeper pools are present. They prefer slowwater zones with sand or mud substrates. They will often move into shallow, warm waters during the day, moving to deeper pools at night. The creation of the reservoir on the Columbia River above Wells Dam has resulted in more slow water habitat near the mouth of the Methow. This slower water with finer substrates and a mix of deep areas with shallow margins, provides ideal conditions for redside shiners. They will also use off-channel habitat zones including sloughs, ditches, and side pools. If aquatic vegetation is present, they will utilize it for cover.

Details of redside shiner distribution are minimal for the Methow River and its tributaries. Any observations of redside shiners should be reported to the Methow Native Fish Hotline at (509)-341-4341.



Nuptial tubercles appear on the heads of male redside shiners during spawning. They are small, raised portions of the skin that may help attract mates for spawning

Longnose Dace *Rhinichthys cataractae*
Speckled Dace *Rhinichthys osculus*

Dace are a members of the minnow family (Cyprinidae). Their preference for dwelling in the interspaces of substrate in swifter waters makes them hard to see and difficult to detect. Few studies have focused on dace in the Methow River and there is minimal information about their specific distribution.

Identifying Features

Both Species:

- **Narrow elongated body shape**
- **Visibly overhung snout extent varies by species**
- **Single dorsal fin**
- **Lateral line runs entire body length**
- **Dull brown, gray, and olive coloring**
- **Males exhibit brighter colors during spawning**
- **Adult size range 3-5" (7-12 cm)**

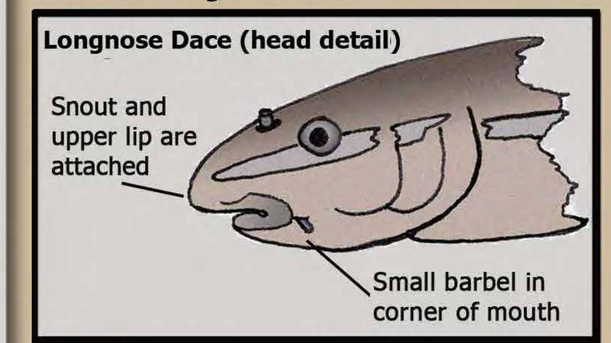
Longnose Specific:

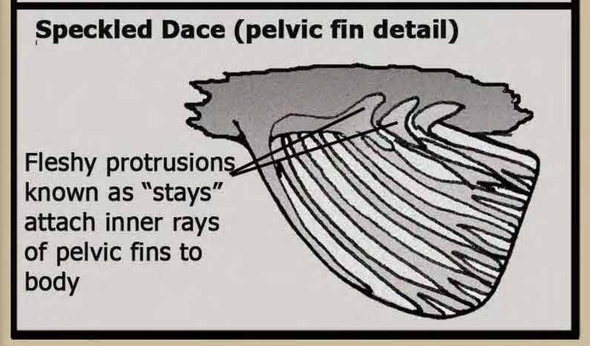
- **Snout very overhung and directly attached to upper lip creating "frenum"**
- **Thick caudal peduncle**
- **Eyes are small in proportion to head size, about 1/3 or less total length**
- **Nostril flap**

Speckled Specific:

- **No barbels at corner of mouth**
- **Thicker body shape and deeper abdominal region**
- **Silvery spotted coloring**
- **Anal fin origin directly below insertion of dorsal fin**

Above-Speckled dace (top) and longnose dace (bottom). Notice deeper body shape and nose size of speckled dace in contrast to that of the longnose dace.





Close up of frenum and nostril flap of longnose dace from the Chewuch River.

Life History and Ecology

Life span for dace is typically between 4-5 years but they may occasionally live as long as six years. Sexual maturity occurs at age two, with spawning usually happening in spring for longnose dace and mid to late summer for speckled dace. Like other cyprinid species, dace have sticky coated eggs which they broadcast release over small gravels where they adhere to the substrate. Eggs may be fertilized by more than one male. Male dace will guard the tiny fertilized eggs until they hatch.

Eggs mature rapidly (in as little as 6 days) with the newly emerged larvae remaining hidden in the gravel for 7-8 days before moving into shallow, slow margins of the stream. Hybridization can occur between different dace species and other cyprinid species due to overlapping spawning times and shared spawning habitat.

Primary food for adult dace are small aquatic insect larvae gathered from the stream bottom. Dace are a prey source for larger predatory species of fish such as bull and cutthroat trout. In some areas dace have been historically used as a bait fish.

Habitat Characteristics

Dace are primarily benthic, spending most of their life dwelling in the interspaces of coarse gravel and cobble substrates. They prefer well-oxygenated, cold, clear waters and typically inhabit shallow runs or riffles. Little is known about these cryptic and elusive species in the Methow River. Confirmed observations are rare, especially for speckled dace.

Longnose dace are the most abundant and widely distributed dace species in the Methow basin. Adults prefer swifter water habitats while young of the year often spend several months maturing in slower water margins with finer substrates.

Speckled dace are usually found in shallow swift water habitats with coarse substrate. They occupy smaller tributary streams as well as portions of the mainstem with suitable habitat conditions.

Above- A longnose dace showing characteristic snout shape and small eye size.

Northern Pikeminnow *Ptychocheilus oregonensis*

Northern pikeminnow are a cyprinid species whose historical native range includes the Columbia and many other western river systems. Their range has expanded in slow water habitats resulting from the construction of hydroelectric dams.

Identifying Features

Juvenile
- **Large eye relative to body**
- **Deeply forked caudal fin**
- **Body is silver colored with lighter underbelly region**
- **Black spot on caudal peduncle region called "schooling mark"**

Adult
- **Slender body shape**
- **Single triangular dorsal fin**
- **Deeply forked tail**
- **Large, toothless mouth**
- **Elongated, tapered, head**
- **Dark green/olive dorsal region, silvery-gray body color with white underbelly**
- **Red and gold tints on fins of males during spawning**

Adult Size Range
- **Average 8-12" (20-30cm)**
- **Weight 2-5 lbs. (1-2.5 kgs)**
- **Larger specimens may reach lengths over 24" (60 cm) and weigh over 20 lb (9 kg)**

Above- Adult pikeminnow showing flattened head and corner of mouth extending to front margin of eye. Below- Juvenile pikeminnow, note forked tail with red-orange tint.

Adult pikeminnow schooling in the lower Methow River.

Life History and Ecology

Northern pikeminnow are the largest member of the minnow family present in the Methow River. They can live up to 16 years, reaching sexual maturity at 5-6 years. Spawning usually occurs from late spring to early summer as water temperatures begin to rise. Preferred spawning habitat is shallow waters with gravel substrates. Females produce an average of 40,000 eggs per year. Like other cyprinids, they broadcast adhesive-coated eggs over their spawning area which then drift to the bottom and stick to small gravel.

Young pikeminnow are opportunistic feeders consuming primarily aquatic invertebrates. Larger fish are well-known for their predatory behavior on other species. They will consume young salmonids, sculpins, suckers, and other minnow species. The creation of the reservoirs associated with hydroelectric projects has increased the deeper, slow water habitats preferred by pikeminnow. Young salmonids moving through turbines or spillways often fall disoriented into these deeper waters where pikeminnow wait to prey on them. They are effective predators with some estimates calculating that they consume several million salmon smolts annually in the Columbia River.

Attempts to help reduce predation have resulted in the creation of bounty programs that pay anglers for pikeminnow. Since their inception in 1990, these bounty programs have paid out several million dollars annually to successful pikeminnow anglers. Based on the number of pikeminnow turned in for bounty and annual program budgets, some estimates put eradication costs at over $17.00 per fish. The majority of fish turned in for bounty are harvested below the lower dams on the Columbia River.

Habitat Characteristics

Pikeminnow are native to the Columbia River and many of its larger tributaries. Their preference for slow water habitats of streams and rivers has allowed them to thrive in slack water zones of reservoirs created by hydroelectric dams. Their distribution within the Methow River is not well documented, but recent observations show that they are abundant and in slower waters near the mouth and in deeper pools and runs in the mainstem as far upstream as Carlton.

An adult pikeminnow, notice the proportion of the head to overall body length.

Chiselmouth *Acrocheilus alutaceus*
Peamouth *Mylocheilus caurinus*

Chiselmouth and peamouth are two closely related members of the minnow family. They are similar in appearance to northern pikeminnow, but have distinct mouth shapes that can be used for identification.

Identifying Features

Both Species:

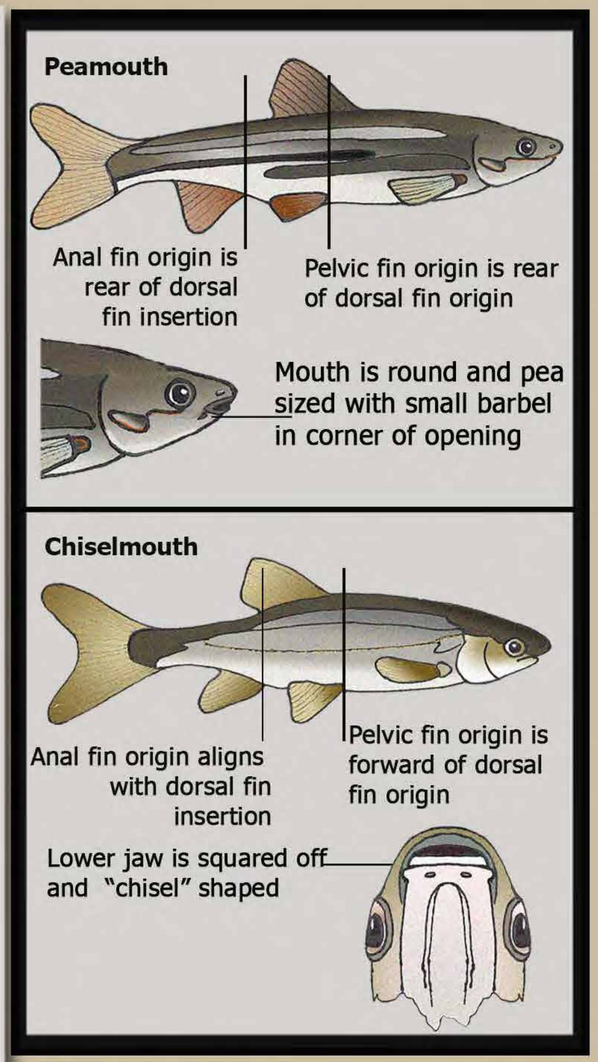
- Long slender body shape
- Deeply forked tails
- Spineless fins
- Silver-white bellies

Peamouth Specific:

- Round, pea-size mouth opening
- Pelvic fin origin rear of dorsal fin
- Anal fin origin aligns to rear of dorsal fin insertion
- Two dark lateral lines
- Dark brown to green dorsal region with dark lateral stripes
- Orange-red patches on flanks and heads during spawning
- 8 rays in dorsal fin
- Small barbels at corner of mouth
- Corner of mouth ends before eye
- Average adult size range 12-14" (30-36 cm)

Chiselmouth Specific:

- Soft upper lip with straight, rigid "chisel" shaped lower lip
- Pelvic fin origin below or slightly before dorsal fin origin
- Anal fin origin lines up with rear of dorsal fin insertion
- Single, dark lateral line with slight downward curve in mid region
- Average adult size range 10-12" (25-30 cm)



Adult chisel mouth showing distinct lower jaw.

Life History and Ecology

Peamouth and chiselmouth share similar spawning patterns to other cyprinids found in the Methow Basin. Spawning usually happens in late spring to early summer as water temperatures approach 60ºF (14ºC). Peamouth females can produce 5,000-10,000 eggs while chiselmouths produce about 6,000. Both species broadcast spawn eggs over gravel or other coarse substrates, typically in slow water margins with temperatures warmer than the mainstem. Both species may hybridize with other species of minnows.

Young fish of both species mature rapidly, feeding on aquatic insects and plankton. Adult peamouths are omnivores preying on snails, micro-crustaceans, plankton, and occasionally other fish. Adult chiselmouth are obligate algivores, utilizing their unique mouth shape to aid their algae consumption. Both species are preyed upon by larger fish including salmonids. As such they are a valuable link between lower components of the food chain and larger species of fish and other animals including snakes, osprey, mink, eagles, and kingfishers.

Habitat Characteristics

Both species are found at varying densities throughout the interior Columbia Basin. They typically reside in warmer slow water margins where algae and aquatic plants are present. In the Methow River, this habitat occurs primarily at the mouth of the mainstem where reservoir conditions created by Wells Dam are found.

They have been studied very little in the Methow resulting in minimal data on the specifics of their local distribution. Any observations should be reported to the Methow Native Fish Hotline at (509)-341-4341.

Right- Adult peamouth shows rounded mouth shape. Below- An adult chiselmouth, notice alignment of anal and pelvic fins in relation to dorsal fin location.

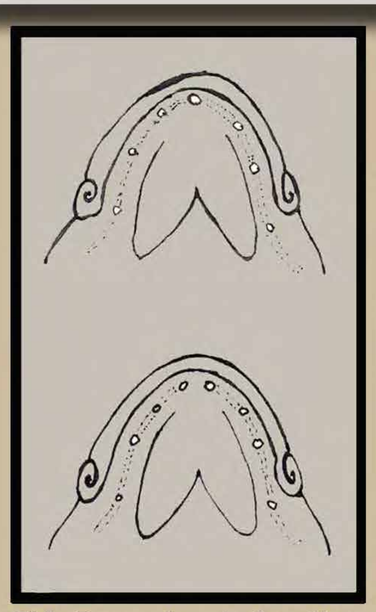
Sculpins: **Mottled** *Cottus bairdii*, **Paiute** *C. beldingi*, **Prickly** *C. asper*, **Shorthead** *C. confusus*, **and Torrent** *C. rhotheus*

Although sculpins are widespread throughout the Methow basin, specific information on their local distribution and life histories is minimal. Sculpin are notoriously difficult to identify to species level, primarily because many are very similar in appearance. Detailed or lethal methods are often required for positive identification.

Identifying Features
(All species)

- **Large head to body ratio**
- **Dorsally-flattened, cod-like body shape**
- **Large pectoral fins**
- **Eyes close together, located near top of large head**
- **Mottled coloration in drab olive, browns and gray**
- **Two dorsal fins**
- **Pelvic fins situated on underside of body just behind pectorals**
- **Narrow caudal peduncle**

Above- Two different mottled sculpin show color variations; notice flattened head, double dorsal fins, and large pectoral fins. Below- A frontal image of a mottled sculpin shows the distinctive sculpin head shape.



Chin Pores -Located on the underside of a sculpin's head, the presence of one or two pores in the front center can be used to identify species type. (see chart p.44)

Sculpin Species Identification Chart

Sculpin Species	# Of Chin Pores	Head Size As % of Body Length	Dorsal Fins Connected	Average Max.Adult Size(mm)	Lateral Line End Point	Prickle Pattern On Body	Other Identifiers
Mottled	2	>26%	No	150	Extends to Tail	Small Patch Behind Pectorals	Nubbles on top of head and between eyes, smooth eyelid skin
Paiute	2	23-25%	No	127	Beneath 2nd Dorsal	Prickles Absent	Palantine teeth typically absent or minimal if present.
Prickly	1	23-25%	Yes	150	Extends to Tail	Body Well Covered	# Anal fin rays usually greater than 17; 2nd Dorsal has >19 rays.
Shorthead	2	<22%	No	132	Variable	Small Patch Behind Pectorals	Small, thin patch of palentine teeth if present.
Torrent	2	>26%	No	152	Extends to Tail	Typically Well Covered	Head may be flattened; caudal peduncle hourglass shaped.

Life History and Ecology

All species of sculpin typically spawn during spring months. The males play a large role in the process, creating a nest site, luring in one or more females to deposit their eggs, and then serving as protectors of the site until the young emerge. Sculpin larvae may emerge as early as three months after fertilization occurs. Once hatched, young sculpin disperse downstream by being carried along in the current.

Young sculpin feed primarily on zooplankton and aquatic insect larvae, adding larger insects and occasionally small fish, crustaceans, and fish eggs as they mature. Like some other fish, sculpins possess a lateral line containing neuromasts or sensitive nerve bundles. Young sculpin use this lateral line to detect movement of potential predators, while older sculpin use it to track nearby prey.

Sculpin are a critical source of food for larger species of fish including rainbow trout, bull trout, and cutthroat trout. As a result, they are nocturnal and spend much of their time maneuvering through small spaces in coarse, cobble substrate, foraging on insects and other food drifting along the bottom.

Habitat Characteristics

Sculpins flattened body shape helps them occupy swift water zones like riffles and cascades. They prefer clear, cold, well-oxygenated waters, and can usually be found in the interspaces of coarse gravel or cobble substrates. Sculpins are distributed throughout the Methow drainage from the smallest tributaries to the mainstem.

Their preference of coarse substrate and clean waters makes them sensitive to human activities like removal of riparian vegetation or bank disturbances that can increase sediment loading and water temperatures. They typically have small home ranges and travel minimal distances up or downstream during their lifetime.

Bridgelip Sucker *Catostomus columbianus*
Largescale Sucker *Catostomus macrocheilus*

Bridgelip and largescale suckers are native members of the sucker family (Catostomidae) and are very similar in appearance. They share several distinctive characteristics found in all suckers which makes them relatively easy to identify. The two species may hybridize making positive identification very difficult.

Identifying Features

Both Species:

- **Toothless "sucker" mouth on underside of head**
- **Single dorsal fin**
- **Spineless fins**
- **Anal fin begins past rear of dorsal fin**

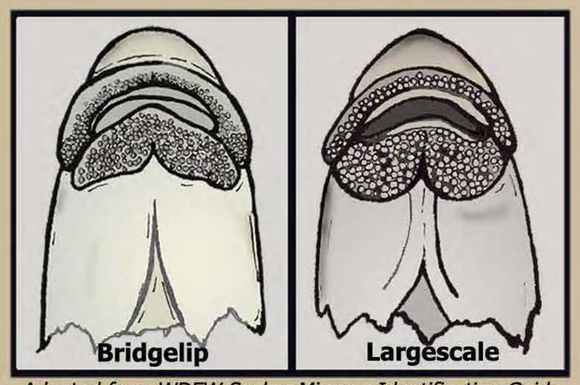
Bridgelip Specific:

- **Partial cleft lower lip with hard cartilage plates that create a "bridge" between left and right lobes**
- **Red lateral band on breeding males**
- **Typically 12 dorsal rays**
- **Average adult size range 10-15" (25-40 cm), max 20" (50cm)**

Largescale Specific:

- **Fully cleft lower lip**
- **Black lateral band on breeding males**
- **Bigger scales, increasing in size toward the rear**
- **13-15 dorsal rays**
- **Average adult size range 12-16" (36cm), max 25" (64cm)**

Above- A spawning male bridgelip sucker with red lateral band. Below- A largescale sucker, notice well defined scales.



Adapted from WDFW Sucker Minnow Identification Guide

Close examination of the mouth region can help determine sucker species type.

Life History and Ecology

Suckers typically spawn in late spring when water flows are high and temperatures still relatively cold. They prefer areas of rivers with large gravel or cobble substrates. Females release eggs while surrounded by a group of males that may all contribute to fertilization. Female bridgelips can release between 10,000 and 20,000 eggs, while largescale females release between 1,000-4,000. Suckers release their eggs in a dispersed manner over a large area. They are highly adhesive and stick to substrate versus being buried or covered like salmonids. This trait, and their high fat content, make sucker eggs prized food for salmonids and other fish such as sculpin.

Suckers are long-lived, with a maximum lifespan for bridgelip around 11-12 years, while largescale suckers may live as long as 15 years. Newly emerged larvae of both species are small, about 1/2" (1 cm), and will often school up in slow back water habitats. These schools are often mixed with larval cyprinids. Suckers transform to juveniles when they are approximately 1" (2.5 cm) long.

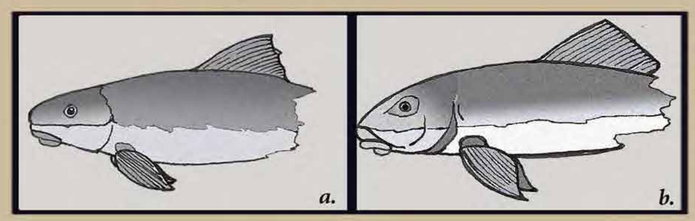
Suckers primarily feed by using their downward-oriented mouth to scrape and vacuum up algae, aquatic insects, clams, snails, crustaceans, zooplankton, chironomids, and occasionally eggs of other fish. They have longer gastrointestinal tracts than other fish, an adaptation that allows them to consume and breakdown plant materials like filamentous algae. Suckers also process zooplankton with the aid of gill rakers located on their gill arches.

Though once perceived to be a major predator of salmon and other game fish eggs, studies have shown that they pose little threat to breeding success of salmonids. Sucker eggs and juveniles are an important food source for other fish. They also are important contributors to the aquatic food chain through their digestion of plant material, and serve as a common prey source for bald eagles, osprey, great blue heron, and mergansers.

Habitat Characteristics

Bridgelip suckers often reside in deeper pools during the day and move towards shallower zones in runs and deep riffles at night. Bridgelip suckers are more adapted to smaller rivers and will use habitats with moderate flows including the Twisp and Chewuch Rivers and Beaver Creek. They are the most common and widely distributed sucker in the Methow watershed.

Largescale suckers are adapted to a wide range of habitats, but usually are found in the mainstem or larger tributaries, preferring slower water and regions with deep pools. They are most frequently seen in the lower reaches of the mainstem. In the Methow, observations of large scale suckers are few and their population numbers and distribution patterns are not well known.



Left- Profiles of the two Methow River sucker species, a.-bridgelip, b.-largescale.

Three-Spined Stickleback *Gasterosteus aculeatus*

Three-spined stickleback are members of the family Gasterosteidae and one of the most widely distributed freshwater species in the world. Their taxonomy is complex and it is believed that further research will split three-spined stickleback into additional species and sub-species. Owing to their rather unique appearance, stickleback are unlikely to be confused with any other fish species in the Methow.

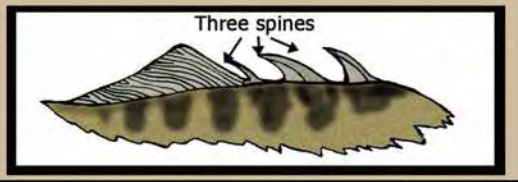
Identifying Features

- **Three predominant spines on dorsal fin**
- **Pelvic fin comprised of one spine and one ray**
- **Bony plates along flank**
- **Lack scales**
- **Pointed head**
- **Narrow caudal peduncle**
- **Olive to dark green with brown mottling**
- **Spawning males possess red flanks and iridescent blue eyes**

Adult Size Range

- **Average length 1.5" – 2.5" (30-60mm)**

Above- A pair of adult stickleback, the female top, showing muted colors while the male displays red flanks and intensified blue eye characteristic during spawning. Below- Diagram of expanded dorsal region showing location of the three spines on a stickelback.



Adult male three-spined stickleback showing large blue eye, dorsal spines, and narrow caudal peduncle.

Life History and Ecology

Three-spined stickleback can live up to 3-4 years, but the majority of individuals complete their life cycle in just one year. The have complex breeding behavior where males establish nesting territories and construct small nests of aquatic vegetation and algae. The males construct a tunnel within the vegetation and use a sticky substance secreted from their kidneys to solidify the structure. Males entice females to the nest using a zigzagging courtship dance. Upon entering the nest, females lay up to a few hundred eggs which the male then fertilizes. Several females may spawn in the same nest. Males will guard the nest and fan eggs with his fins to provide oxygen to the developing eggs. Spawning usually takes place from May-July, but specific spawn timing for the Methow has not been established.

Stickleback are relatively weak swimmers and likely do not disperse far from their natal waters. They are susceptible to downstream displacement during high flow events and will seek out floodplain and stream margin habitats to avoid high velocity streamflow. As such, functional and connected floodplain habitat is an important characteristic of high quality stickleback habitat.

Stickleback are visual foragers and consume a variety of prey including small crustaceans, copepods, ostracods, midge larvae, and algae. They are a common prey source for salmonids and pikeminnow as well as bird species including mergansers, kingfishers, and great blue herons. Their spines and armor plating are believed to be adaptations to deter predation.

Habitat Characteristics

Three-spined stickleback can be found in a variety of habitats including rivers, lakes, as well as both marine and brackish environments. In streams, they prefer quiet waters within slower moving reaches. They are often found inhabiting stream edges and bottoms over gravel, sand, and mud substrates and areas with close association with aquatic vegetation that provides food, cover from predators, and spawning sites. Like many native fish species, they require cold and clean waters for long-term persistence.

Three-spined stickleback are distributed in stream and lakes throughout Washington and are abundant throughout the Columbia River Basin, including Lake Chelan. Distribution in the Methow has only recently been established and currently they have only been observed in the vicinity of the Impoundment Zone.

A pair of three-spine stickleback in the lower Methow River.

Pacific Lamprey *Entosphenus tridentatus*

Pacific lamprey are one of three species of lamprey native to the Columbia River. They are prehistoric members of the class Agnatha, meaning jawless fish. The larval stage lamprey are referred to as "ammocoetes" while the smolt stage are known as "macropthalmia".

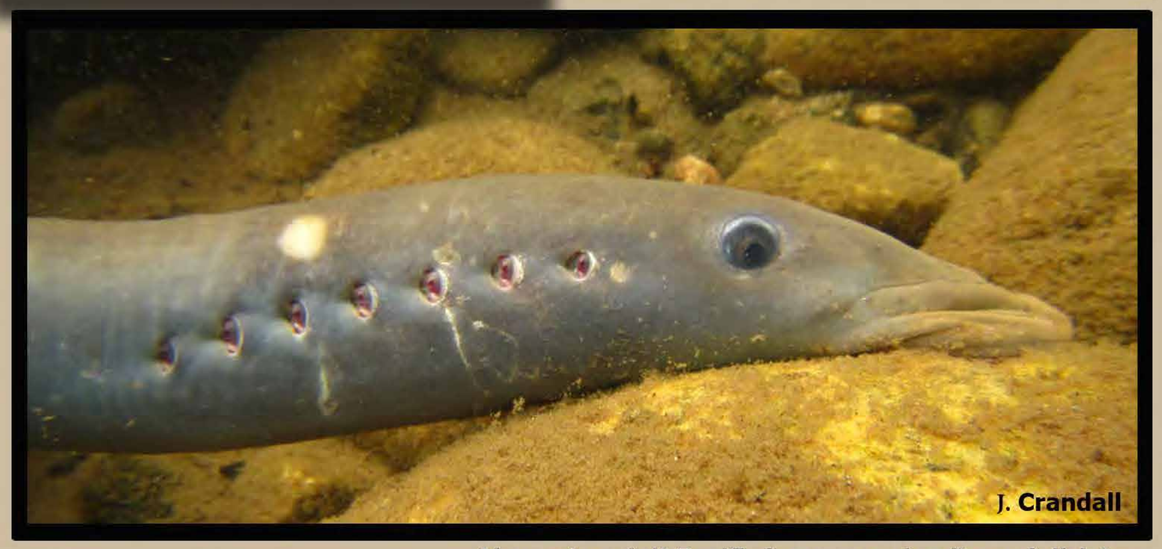
Identifying Features

Ammocoetes
- **No true mouth, instead an "oral hood" opening**
- **No eyes, they are blind**
- **Silvery brown body color**

Adults
- **Long, scaleless, eel-like body**
- **Round, disc shaped, jawless mouth on underside of head**
- **Dark gray brown body color**
- **Single nasal opening between the eyes**
- **Seven pairs of brachipores (not gills) behind eyes**
- **Two long dorsal fins with lobes**
- **No bones or cartilage**

Size Range
- **Ammocoetes 2-5" (5-20cm)**
- **Macropthalmia 5-8" (13-25cm)**
- **Adults 24-36" (38-64cm)**

Above-A pair of adult Pacific lamprey on a redd during spawning. Below- An ammocoete close up showing brachipores and undeveloped eyes.



Above-An adult Pacific lamprey using its oral disk to hold in the current of the Chewuch river.

Life History and Ecology

Pacific lamprey are anadromous, spending time in both fresh and salt water environments. Although specific observations in the Methow Basin are lacking, spawning likely occurs between June and July, with adults laying eggs in gravel substrates. Ammocoetes emerge from eggs in roughly three weeks and move downstream to slow water habitats that have sand or other fine sediment substrates. Ammocoetes live as filter feeders buried in the substrates eating mainly diatoms and algae for four to seven years. Ammocoetes often move downstream during high flow events, but may remain in one location for several years.

Eventually they transform into juveniles called marcropthalmia and begin migration towards the ocean. As they transform, their mouth develops teeth on the sucking disc that is used for parasitic feeding. They spend up to three years in the ocean living as parasites on a variety of fish species including salmon, pollock, rockfish, and flatfish. Young migrating lamprey may be preyed on by larger fish and birds while adults may be eaten by sharks, sea lions, bald eagles, and larger fish.

Adults eventually move to freshwater spawning grounds, swimming and using their mouth to pull themselves over obstacles as they travel upstream. As with other anadromous fish, they face numerous threats along their migration route including dams, poor water quality, predation, and inadequate water flows. It is believed that adults follow pheromones released by ammocoetes to help navigate to spawning grounds. Adults arrive in the Methow between September and October, hold in deep water during the winter, and will spawn the following spring.

Lamprey were a favored food source of many native peoples in the Columbia River Basin, valued for their high fat and oil content. They are considered primitive fishes and fossil records show their presence as far back as 400 million years ago. Lamprey outlived the dinosaurs and are considered to be the oldest living vertebrate on Earth. They have declined rapidly in the Columbia River in recent years with only 322 adults counted passing through Wells Dam in the last five years. Recently, the Yakima Nation has initiated an adult lamprey translocation program to bolster population levels. Local monitoring suggests good larvae recruitment from these adults.

Habitat Characteristics

Lamprey require cold, clean waters with a variety of habitat types and substrates. As noted, they will spawn in gravel substrates at the tailout of riffles typically above an area with good ammocoete habitat. Zones with fine substrate, such as silt and sand within slow water habitat are needed for the ammocoete rearing. Returning adults will winter in and around large boulders and bedrock substrate.

Within the Methow, larvae have been seen in sandy beaches and silty backwaters of the mainstem and Chewuch River. Old timers recount days where the beach in Carlton was avoided because of "high number of eels" likely a reference to ammocoetes that were using the sandy substrates there. Adult lamprey sightings in the Methow are rare and all observations should be reported to the Methow Native Fish Hotline, (509) 341-4341.

Western Brook Lamprey *Lampetra richardsoni*

Western brook lamprey have only recently been documented within the Methow watershed. To date, their presence is limited to a small number of ammocoetes found in the Chewuch River. No observations of adult western brook lamprey have been documented and their distribution and abundance remains unclear. All observations of this species should be reported to the Methow Native Fish Hotline at (509) 341-4341.

Identifying Features

- **Slender, eel-like body**
- **Round disc shaped mouth**
- **Teeth dull and not well formed**
- **Two dorsal fins**
- **Darkish brown coloration, lighter on belly**
- **Tail pigmentation patterns of ammocoetes can be used to distinguish them from Pacific lamprey**

Size Range
- **Ammocoetes 1-6" (25-150mm)**
- **Adults 6-7" (150-175mm)**

Above- Western brook lamprey using its mouth to cling to the substrate.

A comparison of different life stage western brook lamprey, adult top, juvenile middle, and transforming ammocoete on the bottom.

Life History and Ecology

Western brook lamprey are one of two species of lamprey found in the Methow watershed. Until recently, and despite extensive fish population monitoring efforts, there were no observations of this species in the Methow. Yet, in 2016, genetic (DNA) testing of several ammocoetes from the Chewuch River revealed that *Lampetra* was indeed present.

While Western brook lamprey share many characteristics with Pacific lamprey, such as the eel-like body, sucking disc, and a protracted ammocoete phase, there are several differences between the two species. Most notably, western brook lamprey express a resident (non-anadromous) life history, and do not migrate to the Pacific Ocean and back like Pacific lamprey. Also, they are not parasitic as adults and instead forgo feeding after adult transformation. Western brook lamprey adults are much smaller (~7") in length compared to adult Pacific lamprey (~30-36").

Western brook lamprey have an approximately 6-7 year life span with the majority of this time spent as larval ammocoetes. Ammocoetes transform into adults in late spring. Adults begin to mature soon thereafter in preparation for spawning in the summer, thus the adult phase may last only 5-7 months. Spawning usually occurs in low-gradient riffles and glides and redds are excavated in gravel and sand substrates. Several females may spawn within one redd. Redds for Western brook lamprey are smaller (15-20 cm diameter) than those of Pacific lamprey. Similar to Pacific lamprey, Western brook lamprey die after spawning. The specific timing and location of spawning in the Methow is unknown.

Similar to Pacific lamprey, Western brook ammocoetes are blind. They are most commonly found in patches of fine sediment, primarily silt and sand, within areas of low water velocity along stream margins and in pools. As filter feeders, they help to maintain water quality and feed on an assortment of prey items including diatoms, algae, copepods, and larval midges.

Habitat Characteristics

Above- An adult western brook lamprey.

Similar to other native fish in the Methow, western brook lamprey require cold, clean, and complex habitat to support their persistence over time. As described above, ammocoetes require fine substrates to burrow into. They settle into this type of habitat soon after hatching and emergence from their natal redd. Information about adult habitat use prior to spawning is not well documented, but is likely to include cover elements such as large wood and boulders where they can escape predation. Riffle habitat with small cobble, gravel, and sand is preferred for spawning.

Brook Trout *Salvelinus fontinalis* (non-native)

Identifying Features

Fry and Parr

- 8-10 parr marks
- Small amounts of red and yellow spotting
- Black "mustache" on upper lip

Adult

- Light orange, yellow, and red spots with pale blue halos against a dark green body
- Worm-like vermiculations along dorsal region
- White leading edge followed by dark stripe on pectoral, anal, and pelvic fins
- Breeding fish have orange sides and dark bellies
- Larger breeding males have kyped jaw

Adult Size Range (locally)

- Average adult size range 8-14" (20-36 cm), max 20" (50 cm)

Above-Adult brook trout showing spawning colors and white leading edge on pelvic, pectoral, and anal fins. Below- Young brook trout showing typical spotting colors and leading white edge on lower fins.

Brook trout are an introduced salmonid species that were planted throughout many Eastern Washington waters including the Methow. Once viewed as prized game fish, they are now seen as a threat to native salmonids and other fish species. They compete for food resources, predate on other salmonids, and will hybridize with bull trout, thereby threatening the genetic integrity of that native species.

Brook trout are a char native to Eastern North America and are genetically similar to native bull trout. They reproduce earlier and at higher rates than bull trout, allowing them to displace native populations. In smaller streams, they may compete with native cutthroat and redband trout populations for food and spawning habitat.

Brook trout prefer clear, cold waters but can exist in a diverse variety of habitats including, small streams, larger rivers, beaver ponds, and lakes. Within the Methow subbasin they are often found in small lakes and beaver ponds and are less prevalent in larger streams. Brook trout thrive in spring-fed streams and ponds that lack seasonal variation in temperature and flow.

Brown Trout *Salmo trutta* (non-native)

Identifying Features

Fry and Parr

- Orange pigment around adipose
- Small black and red spots, more visible in parr
- Wide caudal peduncle

Adult

- Black spots with light halo on dorsal, head, and sides, red spots on sides of some fish
- Thick body shape
- Dorsal region is olive brown and belly region is white to yellow
- Both jaws have visible teeth
- Large mouth, maxillary extends well beyond rear of eye
- Square-shaped tail fin

Adult Size Range

- Average adult size range 12-25" (30-64 cm)
- Large specimens can exceed 35" (90 cm) and 25 lbs. (11 kg)

Top- A brown trout fry showing large mouth and orange pigment on adipose. Above- A juvenile brown trout with red and black spotting and parr marks. Below-An adult brown trout with more defined spots and squared tail.

Brown trout are native to Europe, western Asia, and the Atlas mountains of North Africa. They were brought to North America in the late 1800s. Brown trout were first planted in Washington waters in the 1930s with varying degrees of success. In the Methow subbasin they are found primarily in lakes and ponds where they have been stocked. At one time brown trout were raised in a small private operation located on Swaram Creek where they may have gained access to the creek and potentially the Methow drainage. At this time their presence in the mainstem Methow is minimal and observations are scarce.

To a lesser extent than brook trout, brown trout are a threat to native populations of redband and cutthroat trout as competitors for food resources. Larger brown trout are also highly piscivorous and will predate on other native fish species as well as amphibians. They are fast growing and may reach lengths of 3-9" (7-22cm) in the second year. They are more adaptable to warming water temperatures than native salmonids and can exist in a variety of habitats from ponds to larger rivers. They become sexually mature between 2 and 3 years old, are capable of repeat spawning, and may live over 25 years in ideal conditions.

Common Carp *Cyprinus carpio* (non-native)

Identifying Features

- Dark colored head with brown to gold colored body and light under belly
- Large scales with dark spot at base
- Small, downward oriented, round mouth
- Pair of barbels on either side of mouth
- Long dorsal fin extends close to rear margin of anal fin
- Thick body shape with hump at front of dorsal region
- Pelvic and anal fins may have orange tint

Adult Size Range

- Average size range 25-30" (63-76 cm), 10-15 lbs (5-7 kg)
- Some warm waters specimens may exceed 40 lbs (18 kg)

Above and below- Adult carp showing large body, long dorsal fin, downward oriented mouth, barbels by sides of mouth, forked tail, and large visible scales.

Common Carp are a Eurasian species that have been introduced throughout much of North America. They are the largest member of the Cyprinidae family, reaching weights over 40 pounds in ideal conditions. They are found locally in the impoundment zone above Wells Dam extending into the mouth of the Methow River. Their preference for slow shallow water with warmer temperatures and aquatic vegetation has limited their spread further upstream in the Methow River. There is minimal data about the extent of their population numbers locally.

Carp are a fast-growing fish that consume large amounts of aquatic vegetation. Other foods include aquatic insects, mollusks, crustaceans, and occasionally small fish. They are largely considered a destructive invasive species that may rapidly alter an aquatic ecosystem and displace native species. As they forage they will uproot aquatic vegetation and increase water turbidity by stirring up substrates. Local populations are know to concentrate heavy metals and other contaminants and the Washington State Department of Health advises that they be eaten sparingly.

Brown Bullhead *Ameiurus nebulosus* (non-native)

Identifying Features

- Brown to black sides and dorsal region with light white to yellow belly coloring
- 4 pairs of barbels on snout
- No visible scales on body
- Large flattened head shape
- Small adipose fin present
- Anal fin is longer than dorsal fin
- Thick caudal peduncle

Adult Size Range

- Average adult size range 8-14" (20-36 cm), 1 lb (0.5 kg); larger sizes possible in warmer waters

Brown bullhead are members of the catfish or Ictaluridae family and are native to many waters of eastern North America. They were introduced to several areas in Washington state including portions of the Columbia River. Like other catfish species, they prefer slow water habitats with warmer water temperatures and soft substrates. In the Methow River they are found in the lower Impoundment zone and have been seen as far upstream as the Winthrop area. They are also present in several local lakes and ponds. There is min-imal information on their pop-ulation numbers in the Methow River.

Top- An adult bullhead in shallow warm water margin of the Methow River. Above-A bullhead showing facial barbels and large flat head.

Bullhead are omnivorous and feed primarily at night. Their diet consist of aquatic insects, fish eggs, crayfish, small fish, and scavenged dead fish. As an invasive species they are potential predators on native fish and their eggs. They may also compete for shared food resources such as aquatic insects.

Largemouth Bass *Micropterus salmoides* (non-native)
Smallmouth Bass *Micropterus dolomieu* (non-native)

Identifying Features

Both Species

- Two dorsal fins, 8-10 spiny rays in front half, soft rays in rear half
- Squared tail shape
- Hard scales

Largemouth Specific

- Maxillary extends beyond rear margin of eye
- Dark black coloring along lateral line and dorsal region

Smallmouth Specific

- Eye color is deep orange to red
- Maxillary reaches center of eye
- Faint vertical bands of dark pigment on sides

Adult Size Range

- Largemouth average size range 12-24" (30-61 cm) 5 lbs (2 kg)
- Smallmouth Average size range 8-14"(20-36 cm), 3 lbs (1.25 kg)

Above- A largemouth bass, note extent of maxillary and characteristic dark spotting. Below- A smallmouth bass,note red eye and faint vertical striping.

Above- A juvenile smallmouth bass.

Both largemouth and smallmouth bass are native to eastern North America but have been introduced to many western waters for sport fishing opportunities. These exotic species are highly aggressive piscivores that present threats to other native fish and amphibians. Their diet consist of fish, crayfish, aquatic insects, and zooplankton. Smallmouth and largemouth bass are fast growers and heavy feeders with the ability to reproduce rapidly in ideal conditions.

Both species are adapted to a wide range of habitat types including ponds, lakes, and rivers with a variety of water temperatures, however largemouth prefer slower habitats with warmer water temperatures. Both species have been introduced into the Columbia and within the Methow River they live mainly in the Impoundment Zone. Smallmouth have been documented as far upstream as Winthrop, but their abundance beyond the Impoundment Zone appears to be minimal for now.

Yellow Perch *Perca flavescens* (non-native)
Walleye *Sander vitreus* (non-native)

Identifying Features

Walleye

- Visible, sharp teeth both jaws
- Eyes appear opaque dusky-blue
- Bottom half of caudal fin has white tip
- Two dorsal fins; spiny rays on front, soft rays on back

Adult Size Range

- Average adult size range 12-20" (30-50 cm) max 28" (70 cm)

Yellow Perch

- 6-8 Vertical dark stripes
- Paired fins are pale orange
- 1-2 Spines on anal fin
- Two dorsal fins; spiny rays on front, soft rays on back

Adult Size Range

- Average adult size range 4-12" (10-30 cm) max 21" (55 cm)

Top- An adult walleye showing two dorsal fins, slender head and body shape, and white tip on lower lobe of caudal fin. Below- An adult yellow perch, notice vertical stripping, orange coloring of pectoral fins, and two dorsal fins.

Walleye and yellow perch are members of the family Percidae, and native to regions of North America east of the Rocky Mountains. They were introduced to western states including Washington for sport fishing opportunities. Preferred habitat for both species is lakes, but they may also be found in larger, slow moving rivers. Both species were planted in the Columbia River above Wells Dam. Within the Methow basin they are primarily found in the slow waters of the Impoundment Zone. Yellow perch can also be found in some local lakes including Patterson and Buck Lakes. Little is known about the extent of distribution for both species in the Methow River.

Walleye are primarily piscivores and as such they are a potential threat to local native fish species. Salmonid smolts migrating through the slow waters of the Impoundment Zone may be preyed upon by larger walleye. Young yellow perch eat zooplankton, fish eggs, and aquatic insects while larger adults will add crayfish and smaller fish. Similar to walleye, adult yellow perch also prey on native fish species.

Glossary of Terms

Adfluvial- Fish that migrate between lakes and streams. These movements are often associated with feeding and reproduction. Cutthroat and bull trout are examples of species that often express this life history in the Methow.

Alevin- (Pronounced Ale-vyn) A young fish in the early stages of growth just after the eggs have hatched. Alevins still have the yolk sac attached, which provides them with nutrients during the first few weeks of growth.

Ammocoete- The larval life stage of a lamprey. Ammocoetes are the most common lamprey life stage observed in the Methow watershed.

Anadromous- Fish that migrate out of their natal river basin to saltwater where they feed and mature before returning to their home streams to spawn. Salmon, steelhead, and lamprey are examples of anadromous fish.

Floodplain- The area surrounding the main channel of a stream that is often flat or relatively uniform in elevation. High flows inundate floodplains and stream channels may migrate through them in time.

Fluvial- A fish that moves between the mainstem and tributary streams. These movements are often associated with feeding and reproduction. Bull trout and mountain whitefish are examples of species that express this life history in the Methow.

Fry- A young fish just past the alevin stage, usually reached shortly after hatching. At this stage fish have absorbed the egg yolk sack but have not grown into the parr stage.

Hybrid- An offspring created by adults of two different species. Hybridization can be a threat to the genetic integrity of native species such as when exotic species like brook trout interbreed with native bull trout.

Kelt- An adult anadromous salmonid that has spawned, migrates back to the ocean, and then returns to repeat spawn. In the Methow Basin only steelhead exhibit this life history trait.

Larvae- An early life stage that some fish undergo before transitioning into juveniles or adults. Lamprey, suckers, dace, and sculpin have larval life stages.

Lateral Line- A group of sensory organs that are used to sense movement and vibration in the surrounding water. These organs are comprised of highly sensitive hair-like cells that alert fish to the presence of prey and predators. These organs often run along both sides of the fish creating a visible "lateral line".

Mainstem-The predominant channel in a watershed fed by smaller tributary streams.

Marine Derived Nutrients- Nitrogen, phosphorous, and other minerals found in the tissues of adult anadromous fish that migrate with these fish from ocean environments upstream into fresh water ecosystems, becoming part of the ecosystem when the fish die and decay.

Parr- Juvenile life stage between fry and smolt when young salmonids typically display vertical pigments known as "parr" marks along their lateral line.

Pool- Slow, deep water zones in a stream created by an obstruction such as a beaver dam or woody debris, or by erosive forces that make a deeper area in the streambed.

Rearing Habitat- The stream habitats required by fish for the process of growing through the juvenile life stage. These habitats may vary by species, but often share similar qualities, such as slow water and abundant cover.

Redd- A depression made by an adult salmonid in gravel substrates where the fish deposit their eggs. Other species, including pacific lamprey, also create redds as part of their reproductive cycle.

Resident- A fish that spends its entire life in the stream reach where it was born.

Riffle- Aquatic habitat characterized by shallow, swift-moving waters with a broken, noisy surface and large, coarse, substrates. Riffle habitats provide feeding zones and oxygen-rich waters for fish.

Riparian Forest- The associated land and plant communities surrounding a stream or river. This area is typically composed of water-loving plants like willow, cottonwood, and dogwood, and provides vital habitat for many species as well as shade, cover, and food for associated aquatic species.

Side Channel- Slow-water aquatic habitats partially or fully isolated from the primary flow of a stream that often provide critical feeding and cover habitat for young fish and holding areas for adult fish during their spawning migration.

Smolt- A young salmonid in the process of migration from a freshwater to a saltwater environment. "Smolting" involves physiological changes that allow fish to live in salt water.

Substrate- The material lining a river or streambed. Aquatic substrates are composed of various sizes of sediment particles including: silt, sand, gravel, cobble, boulders, or bedrock, each providing different functions for the stream environment.

Tributary- A stream that feeds the primary, or mainstem, portion of a river.

Water Quality- The combined chemical, biological, and physical makeup of water used as a reference to determine the overall health of a stream.

Decaying salmon carcases bring vital nutrients to the river and surrounding ecosystems.

The Methow's Cold Water Future

The native fish inhabiting the Methow River watershed have adapted to their freshwater environment over thousands of years. These fish, as well as the other members of the Methow's aquatic ecosystem, rely on cold water for their survival. The volume, timing, and temperature patterns of cold water delivery to streams are important variables and strongly influence several critical aspects of fish life history including feeding, migration, and reproduction.

Currently, the streams of the Methow are supplied by abundant and dependable sources of cold water that originate from the mountain snowpack and numerous groundwater-fed seeps and springs. Yet, under scientifically-based climate change scenarios, cold water habitats across the Pacific Northwest are predicted to become scarcer and more fragmented over time due to changes in air temperature and patterns of snow accumulation and spring runoff. These changes will have profound impacts on cold-water dependent species and ecosystems by reducing the amount of suitable habitat and altering the timing and location of its availability.

Nevertheless, even under the more extreme climate change projections, at least some cold-water habitat is predicted to persist in the Methow watershed that would support cold-water indicator species, such as bull trout, further into the future than in other parts of the Pacific Northwest. It is imperative that we begin the work today to identify, preserve, and effectively manage the cold-water sources in the Methow as this represents perhaps the most viable pathway to ensure our cold water future. For more information, contact the Methow Restoration Council at www.methowrestorationcouncil.org.

Cold, clean water is an essential component for healthy watersheds. Aquatic species, including these Western pearlshell mussels, depend on it for their survival and persistence.

Tips to Keep our River Clean

The Methow River is a valuable resource for fish, farms and all Methow Valley residents. Clean water is critical because it is what we drink when we open the tap in our homes. It is up to us to keep our river clean and healthy. Listed below are a few simple actions (with big effects!) that will help keep our river clean.

- **Conserve water**. Most household water drains away without being used. So use water-efficient appliances (e.g. shower heads, toilets, and washing ma chines) and turn off the water when not needed.
- **Water effectively.** Watering lawns and gardens at night conserves water. Sweep driveways and paths to reduce the need for spraying with water.
- **Use and dispose of household hazardous waste properly.** Do not pour hazardous cleaning chemicals down drains or sewers. Read all product labels and dispose of all hazardous home and yard products properly. The Twisp Transfer Station accepts hazardous waste on the 2nd and 4th Thursdays each month; call Okanogan County Solid Waste at 509-422-2602 for details. Better yet, use non-toxic cleaners around the house.
- **Use natural fertilizers and pesticides.** Using naturally derived products eliminates the need for chemical fertilizers and pesticides which are toxic and can severely degrade water quality. Composted kitchen scraps and yard clippings make amazing fertilizer!
- **Recycle used motor oil.** Never dump used oil down storm drains or into water ways. Recycle used oil at the Twisp Transfer Station or other approved location.
- **Inspect, maintain and clean your septic system regularly.** Faulty septic systems pose a huge threat to clean water. Know your system and its condition.
- **Protect and enhance riparian vegetation.** Streamside trees and shrubs help to keep our rivers cool and provide habitat for wildlife. Do not cut to the edge of streams and where necessary plant native vegetation near streams to enhance degraded areas.
- **Spread the word about the benefits of clean water!** Tell your friends and family and together we can celebrate a clean Methow River!

References

This guide was developed using a variety of information sources. We relied heavily on knowledge and information from local fisheries professionals. Please consult the references below for additional information on the fish covered in this guide.

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