Fisheries

Common Issues

Fish in the Yampa Valley face an array of pressures, such as degraded habitat, movement barriers, rising temperatures, low flows, and competition and predation from invasive fish species. Because so much habitat is found on private land, the role of the landowner in protecting both native and sport fish populations and promoting conservation has never been more important.

Questions to Consider

- Are native fish present? What can be done to support their life cycle?
- Are there diverse habitats within each reach of river or creek including riffles (areas of fast-moving, turbulent water), pools, backwater habitats, side channels, and wood or undercut banks for cover?
- Are there invasive fish species that are harming native and sport fish populations?
- Are there any barriers to upstream/downstream movement of fish?
- Are low flows and/or high temperatures harming fish populations?
- Is there an instream flow water right is this reach, and is it being met?

Principles of River Health

Complexity in Every Segment

Fish require a variety of water depths, flow rates, substrates, and habitat types for success at different life stages. Good stream habitat for both native fish and trout is complex, consisting of deep pools and undercut banks for overwintering and protection from predators, riffles for spawning and for the production of macroinvertebrates (which are their primary food source), and submerged wood, boulders, and side channels for rearing. It is important to have complexity in each segment of the stream.

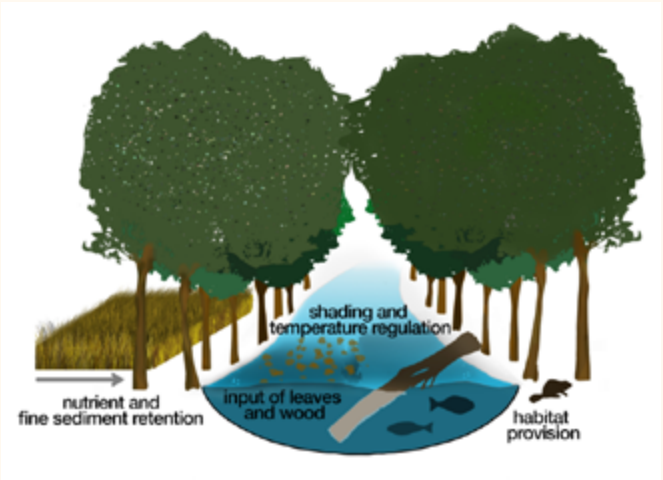
Temperature and Water Quality Matter

Mountain Whitefish are native to the Yampa River | Photo by City of Steamboat Springs

Fish need cool, clean water to survive. For example, native mountain whitefish congregate in deeper pools and rely on late season flows in tributary creeks to access spawning areas. Cooler water holds more dissolved oxygen than warmer water, allowing fish to breathe. Forested areas along streams and rivers provide shade and help to cool the water. Wetland plants serve to filter water and improve water quality. The deep pools found in beaver complexes provide a cool-water refuge for fish. Beaver complexes also increase subsurface-surface water exchange, further cooling the water during summer months.

Healthy Land = Healthy Fish

A healthy riparian zone, lush with vegetation, provides shade and cover for the stream, keeps water cooler, limits rapid bank erosion, filters out sediment and other pollutants before they reach the stream, and provides habitat for insects that fall into the water, providing a critical food source for fish. Eventually, riparian trees and shrubs also fall into the river, creating instream habitat. Human activity can adversely impact the riparian zone. Removing riparian vegetation up to the stream's edge is a common practice, often to create agriculturally productive land, views of the river, or recreational access. This loss of vegetation weakens stream bank structure, and can lead to extensive erosion during high flows. Giving livestock (or people) unrestricted access to a stream often results in siltation of the water, eroded banks, nutrient loading from livestock waste, and loss of riparian vegetation and stream habitat.



Cross section illustrating the importance of riparian vegetation on fish habitat | Image from Freshwater Information Platform

Infrastructure as Barriers

Channel-spanning diversion structures and culverts can create unique threats to fish and other aquatic species. Fish need to move throughout a stream corridor to access different areas and habitat types to help them grow, survive, and reproduce. Diversion dams and culverts can fragment this movement. When habitat is fragmented, fish cannot move to desired habitats, and lack of reproduction can lead to reduced genetic diversity in the population. Additionally, fish can become trapped and killed when they swim into irrigation ditches and cannot escape. In addition, undersized culverts create problems for fish and safety hazards during floods or post-fire debris flows.

Flows are Important

Whether the result of drought, irrigation withdrawals, or other causes, low stream flows can be a serious problem for fisheries and stream health. In the summer, low flows can lead to increased water temperature, which results in less oxygen in the water for fish to breathe. Water diversions that pull water from streams during low-flow periods can be especially damaging, because fish require a minimum instream flow for survival. Sweeps of the river (which occur during a “call” when there is not enough water to meet the demands of water rights users) create dry-up areas that are catastrophic for fish. These sweeps often coincide with high temperatures, which create low-oxygen pools that are stressful for fish. Low flows are a problem during the winter as well, because low flows and colder temperatures lead to more ice and less overwintering habitat. Avoiding river dry-up, establishing minimum instream flows, and releasing additional water during a call are ways to support aquatic ecosystems, including fish.

Recommended Practices or Actions

There are several actions that landowners can take to improve habitat for fish. These actions, described below, include designing diversion structures to allow for fish passage, removing unnecessary culverts, modifying culverts to reduce their negative impacts, preventing fish from entering irrigation ditches, improving riparian vegetation, adding large wood, and maintaining minimum flow levels.

Design Diversions with Aquatic Species in Mind

Some fish species, such as trout, are good jumpers, while species like sculpin, suckers, and dace are not. Structures within the river should be designed to allow for upstream/downstream passage of the fish species present within the particular stretch of stream. For example, an impassible diversion dam can be replaced with a rock weir, often using boulders, that allows fish to swim through. Fish ladders create a gradient passageway to allow fish to swim through or around obstacles like culverts, dams, and diversions. Alternatively, jumping pools of specific depth and location can be built so that trout can jump over dams.

The pool below the dam, on the right side of the picture, is designed to help trout jump past the diversion. This is a barrier, however, to species that cannot jump such as suckers and sculpin. Photo by Roddy Beall, Zenobia Consultants

A diversion structure with an ecological rock ramp feature that allows for fish and sediment passage Photos and Project by Flywater, Inc.

Remove or Modify Undersized and Perched Culverts

Culverts can create a significant barrier to fish presence within stream segments. Fish passage may be blocked by undersized pipes or other design issues such as when the downstream end of a pipe is elevated above the stream water surface, or "perched." Additionally, steep culverts can create a passage barrier by increasing the water velocity flowing through the pipe to a point where fish cannot swim upstream through it. Culverts should be removed if they are no longer required. When they are required, an undersized culvert can be replaced with a design that allows aquatic species passage by attempting to match stream bottom conditions through the culvert, such as "bottomless" arch-culverts or bridges that eliminate culverts altogether.

Culverts should be designed to allow sediment to pass through them; this can most efficiently be done by matching design flow velocities within the culvert with expected stream velocities upstream of the culvert location. Adequately sized culverts and the number of culverts placed should also consider low-flow conditions to maintain year-round stream connection and allow for a 100-year flood event. As a rule of thumb, culverts should provide flow in the bankfull condition plus 2 feet on either side.

Install Fish Screens to Avoid Entrapment

Fish screens are an effective way to prevent fish from entering irrigation ditches. Fish screens allow water to pass into the ditch but keep fish out. A fish screen is often installed at or near an irrigation system headgate. Some designs, while effective, can require maintenance to keep the screens free of sediment and debris.

Restore and Protect Riparian Vegetation

By restoring or preserving riparian forests, landowners can improve fish habitat, cool the stream, prevent erosion of productive land, and keep excess sediment out of the river. Exclusionary fencing or rotational grazing may be important to keep riparian vegetation healthy for the long term. A robust riparian buffer helps fish by increasing cover, food (insects dropped to the channel), habitat (undercut banks, wood), and water quality (decreased water temperatures).

Install Wood Where Appropriate

Large wood can be introduced into the river specifically to support fish by creating deeper pools, increasing cover, providing slow water refuges, and promoting natural stream habitat conditions to support spawning, rearing, and maturing fish.

Surface-placed large wood structure intended to create more complex flow and scour patterns, as well as provide cover and structure for fish Photo courtesy of Eagle County Open Space

Potential locations for wood installation are site specific. They are often installed at an outside bend or the tail of an existing pool. Native trees with rootwads intact can be preferable to logs without rootwads as they more closely match natural conditions. Approximately 20%-30% of the log should be buried into the bank, and wooden posts can be used to secure it in place. The location and angle of the logs is important to avoid redirecting the flow in undesired ways. Intentional placement of wood in a stream should consider downstream infrastructure such as culverts, bridges, and recreational use, as these structures may move in high flow conditions. Ballast can be used to secure structures in place where necessary.

Large wood habitat features installed during restoration for habitat, infrastructure protection, and to support sediment transport processes | Photo courtesy of the City of Fort Collins

Keep Water in the River through Efficiency Improvements

Irrigators can improve efficiency by installing gated pipe, lining ditches, or installing sprinkler irrigation. Operators may be able to divert less water from the stream while still delivering the amount of irrigated water to meet crop demands. Water rights holders who are interested and able may contact the Colorado Water Trust to learn more about voluntary water sharing or leasing programs that can allow for more water in the river without harming water rights holders. All of these efforts can result in keeping more water in the main channel to support fish populations. Fish benefit when minimum flows are enough to allow them to move upstream/downstream, from pool to pool, in search of more favorable cover, water quality, and food availability.

Rebuild the Channel

Excavators build a boulder structure where wood structures are not possible | Photo by Peter Van De Carr

In areas where the river is degraded due to historical alterations and land-use changes, channel realignment and restoration may be warranted. Healthy streams typically have alternating deep and shallow areas called pools and riffles, respectively; habitat structures formed by large wood and boulders; and meanders whose spacing and curvature depends on stream size and gradient. In certain circumstances, heavy machinery can be used to reshape the stream channel and force the desired channel form. However, proceed with caution when embarking on this type of channel restoration; not only does it come with significant design and permitting costs, but often these form-based projects that lock the channel into place while mimicking "natural" river forms fall short if the processes that create these forms are not also restored. Process-based restoration options (both low-tech and high-tech) that seek to restore river function by re-establishing natural processes tend to have more lasting and positive impacts on river health.

Benefits of Implementing Recommended Practices

- Thriving fishery
- Better irrigation systems with reduced maintenance
- Enhanced land values
- Potential income from fishing leases
- Improved water quality

Reference and Resource Materials

Dinosaur National Monument published a Guide to Important Fish Species that is particularly useful for fish identification in the lower Yampa River Basin

CPW has a List of Fish of Colorado that is helpful for identification.

Trout Unlimited developed a very useful Landowner's Guide to Stream Restoration that focuses on the importance of fish species.

Trout Unlimited published A Handbook for Streamside Owners to provide the basic principles and practices of good streamside management to rural and urban landowners.

The NRCS Conservation Practice 395, Stream Habitat Improvement and Management could be used for cost sharing through an EQIP program contract. EQIP provides payments to restore and manage riparian corridor habitat.

The Farmers Screen™ is a horizontal, passive fish screen design that uses hydraulics to manage debris and protect fish. It has no moving parts and does not require power to operate.