



Live Plants

SALMONID HABITAT RESTORATION How-To-Guide for Washington State

Fish First | P.O. Box 1505 | Woodland, WA 98674

LIVE PLANTS

Salmon are known for their ability to return to the stream in which they were spawned to reproduce and complete their life cycle, an ability primarily attributed to olfactory cues. The fish “imprint” upon a stream sometime before they leave it to migrate to saltwater.

In some cases a natural event, such as a flood carrying juvenile salmon downstream of the grounds where they were spawned, can combine with upstream obstacles to cause salmon to imprint upon spawning grounds far downstream of where they were born. When they return years later to spawn, they forsake their natal grounds for the area upon which they imprinted.

This is one in a series of Salmonid Habitat Restoration How-To-Guides for projects in Washington State. It was written to help groups and individuals undertaking similar projects and presumes some knowledge of salmon, habitats and project planning.

Other guides in the series:

- Rearing Pens
- Culvert Replacement
- Nutrient Enhancement
- Live Plants
- Habitat Restoration
- Permitting
- Project Funding
- Streamside Incubation

Years of this happening have resulted in salmon returns being clustered in main river bodies, exposing them to threats and closing off more remote, historical habitat. Live planting is a method of returning fish to these upstream spawning grounds, and reopening their historical habitat. Such projects must be done in collaboration with fisheries biologists to determine the proper equipment and methods to ensure the safe handling of live fish.

Before undertaking a live planting project, check with the appropriate local and federal agencies to ensure it is legal in your region. For more information on obtaining permits see the related How-to Guide on permitting.

This guide is an overview for projects in Washington State. It uses Coho salmon, or silvers, as an example throughout. Requirements and specifics for similar projects in other states and involving other species of salmon will vary.

AN OVERVIEW

The Problem

The ability of salmon to return to the stream in which they were spawned to reproduce and complete their life cycle has been the subject of much research over the years. It has become evident that the process is olfactory based.

Imprinting seems to happen during the transformation from parr to smolt, a sensitive developmental period. They imprint to site-specific odors, and later use this memory as a migratory map to return not only to their natal streams but to the grounds on which they were spawned.

However, these grounds are not always accessible. Over the years we've built bridges, culverts and other obstacles that only provide salmon through access in theory, not in practice.

Young salmon are able to move downstream through these obstacles. But when they return as adults they've already stopped feeding, have fought their way upstream, and have already begun the final stages of their spawning process, which ends in death. These fish are often too tired or too weak to make it through the same culverts they easily passed through as juveniles. When they spawn, it's on downstream grounds, which their young will imprint upon.

In other cases, a spring flood may wash juvenile salmon downstream from the gravel where they were born. They're unable to get past obstructions and return upstream, and they imprint upon these new grounds before migrating to sea. These grounds are where they will return as adults.

Both scenarios result in the same thing—historical spawning grounds upstream of the obstacles cease to be used by salmon. When this happens repeatedly over decades, spawning areas become clustered near the main rivers. Traditional spawning grounds extend almost as far back as the river drainages themselves—salmon spawn high in mountain streams, or thousands of miles inland. Moving spawning grounds away from such areas toward the main river bodies, where they are more exposed to threats, decreases their likelihood of survival.

Salmon rehabilitation programs that replace culverts and rebuild upstream habitat are useless if the fish don't know to return there. Essentially, they've been trained to abandon entire stretches of river. Restoring habitat creates false spawning grounds.

For these grounds to become active, fish need to be “retrained” to return to them.

The Solution

To retrain fish, they are transplanted to target spawning areas where their young can imprint, ensuring the next generation of salmon return. Target areas are safer, enlarge the habitat, and spread out the spawn, which means a flood or other traumatic event to one part of the river won't wipe out an entire generation of salmon.

LIVE PLANTS: THEORY AND METHODS

The theory of live planting is simple: Fish are captured just prior to spawning and transported in pairs upstream to historical spawning grounds. For coho salmon, which spawn from October-December, this means transplants occur during the fall.

For it to work, future access to target grounds must be unfettered, and the grounds must be appropriate for the survival of juvenile salmon. Live plants work best in conjunction with other salmon restoration programs, such as nutrient enhancement and habitat rehabilitation.

In order to successfully transport fish you'll need the following:

- **Transport container.** These containers fit in the back of a truck to enable capture fish to be immediately relocated upstream, and are oxygenated to keep the fish alive. Typically 300-400 gallons, they will comfortably hold 20 fish in a container—ten matched pairs. Costs vary, but expect to pay around \$500.
- **PVC pipe.** Pipes must be large enough in diameter to fit the tank's outtake and to allow mature salmon to fit, and long enough to reach the stream from the truck.

Live plants must be done in collaboration with a hatchery. Hatchery biologists can help ensure the safety and proper handling of the fish, as well as provide the necessary permits. In addition, they'll capture the fish, and can provide the proper equipment.

Washington law requires that hatcheries take all hatchery fish from a stream. Typically, they'll keep enough fish to provide the milt and eggs for the hatchery, and the remainder are given away or sold. Sometimes wild fish follow hatchery fish and return to the hatchery. The law also requires hatcheries remove all wild fish that make their way to the hatchery and return them to the wild.

These fish can be used for live plants. Hatchery personnel will capture the fish and pair them, and load them into the oxygenated tank for transport.

Things to consider when transporting live fish:

- When targeting habitat, choose the best habitat you can find initially. Once live plants have been successful there, start aiming further upstream, sticking with historical spawning grounds. While appropriate habitat is important, to a large extent salmon will build their own habitat—adults move gravel into location and over generations create good spawning grounds. More important than good habitat is making sure juvenile fish will have clear, unobstructed access downstream when they migrate to saltwater, and sufficient passage upstream when they return as adults to spawn.
- When determining how many fish to plant at a time, the answer is simple: as many as you can get. The greater the population that spawns in a location, the greater the chance of successful returns. Greater numbers of returning adults also mean higher levels of nutrients in the water, crucial to juvenile survival.
- Stream features are not critical when selecting a plant site. Access, however, is—choose a location where the truck carrying the tank can reach close enough to the stream to extend the pipe in the water. As long as the water level is high enough for fish to move, they'll find the best habitat in the area for spawning.

- When releasing fish from the tanks into the stream, begin by draining enough of the water from the tank through the pipe to both sufficiently wet the pipe and allow manual access to the fish. Then, handling the fish one at a time as little as necessary, position them at the outtake to the pipe.

Monitoring Live Plants

Once fish have been live planted in a new area, the site should be monitored to ensure the plant was successful. This process is as simple as walking along the area downstream of the plant site and counting redds, or the spawning beds created by adult salmon, or waiting until the following summer and looking for juvenile fish.

On streams where culverts have been repaired or replaced and upstream grounds obstructed, the presence of any juvenile salmon upstream means the plant was successful.

ADDITIONAL INFORMATION & RESOURCES

Copies of this document are available through Fish First, and can be found on the Web at www.fishfirst.org. You'll also find a library of how-to guides and fact sheets as well as other resources and information to help with salmon restoration projects.

In addition, here's a list of links to help you find information on live plant projects.

- **Washington State Department of Ecology**
www.ecy.wa.gov
- **Washington State Department of Fish and Wildlife**
www.wdfw.wa.gov

Information in this document came from Fish First volunteers and contractors.

Written and produced by Chris Bernard at *italics media*. www.italicsmedia.com

Fish First
P.O. Box 1505
Woodland, WA 98674
360.713.7460

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