

## Marking Salmon and Steelhead

Anadromous salmon and steelhead range from California north to Alaska as they travel from their birth streams to the ocean, then return to spawn the next generation. Along the way, they migrate through many political jurisdictions and fisheries. Managers have long recognized the need for effective tracking and marking methods to improve fisheries management.

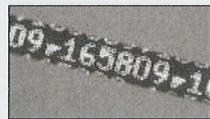
### How CWT Works

The two marking methods most widely used for harvest management today are the Coded Wire Tag (CWT) and Mass Mark (an external, visible mark). About 50 million salmon and steelhead are coded-wire tagged by 54 different entities along the Pacific Coast of the United States. Many millions more are mass marked.

Development of coded-wire tags emerged in the late 1960s but awaited technological advances to make them widely applicable in the field. Today's tags are tiny pieces of magnetized stainless steel wire 0.25 mm in diameter. Each tag is marked with rows of numbers denoting specific batch or individual codes. Tags are cut from rolls of wire by an injector that hypodermically implants them into suitable tissue, usually in the snout of young fish, before they are released from the hatchery. The standard length of a tag is 1.1 mm, but for very small fish half-length (0.5 mm) tags are used. For larger fish one and a half (1.6 mm) or double length tags (2.2 mm) may be used.



Coded wire tag  
(actual size 0.25mm  
in diameter)  
Northwest Marine  
Technology, Inc.



Coded Wire Tag  
Northwest Marine  
Technology, Inc.



Tag  
implanted  
into  
juvenile's  
snout  
Northwest  
Marine  
Technology,  
Inc.



USFWS,  
Howard Gearns

When adult salmon and steelhead are caught in various fisheries, or when they return to a hatchery, they are electronically scanned for CWT presence. Data from recovered tags is used to manage fisheries and track the movements and survival rates of specific fish stocks.

### Mass Marking

Mass marking refers to the removal of the adipose fin, a small fin on the fish's back near the tail, from young hatchery fish before they are released into the wild. Removal of the fin identifies



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hatchery fish, which can be retained in mark-selective fisheries, from their wild counterparts. Such marking allows harvest of hatchery fish while protecting wild fish in waters where both stocks are present. Mass marking of most salmon and steelhead reared at federally-funded hatcheries and available for harvest in selective fisheries is currently required by Federal law.

Over the last 30 years most CWT and marking programs have used trailers where the tagging and marking equipment was operated by humans. More recently, computer-controlled automated trailers are replacing older trailers.

### Automated Trailers

Each year, nearly 35 million fish are mass marked at National Fish Hatcheries. Over six million are also marked with CWT. Special trailers, each costing up to a million dollars and supervised by specialists from the Western Washington Fish and Wildlife Office in Lacey, Washington and the Columbia River Fisheries Program Office in Vancouver, move from hatchery to hatchery during the spring and fall, linking up with trained local crews to mark fish for release into Washington, Oregon, and Idaho waters.



USFWS, Doug Zimmer



When the trailer arrives at a hatchery it is parked next to the raceways where the fish to be marked are kept. Flexible tubes are run from the raceway holding the fish into the trailer's sorting system and from the trailer's fish collection system back to a nearby raceway.

The tiny fish, so small that they are measured by how many it takes to weigh a pound, are drawn from their raceway into the trailer's system by a special pump that delivers them into a sorting mechanism. This mechanism uses video imaging to sort the fish into pre-selected size categories. The fish move down tubes to a holding tank attached to an adipose fin-clipping machine that has been pre-set for fish of their particular size.

Sorting  
Mechanism  
USFWS,  
Doug Zimmer



From the holding tank the fish swim into a channel where a series of sensors track their progress to the clamping system. If for some reason this process takes longer than five seconds, to prevent injury, the fish is directed into a holding bin for reprocessing.

Holding tank  
USFWS,  
Doug Zimmer





USFWS, Doug Zimmer

The clamping system gently holds the fish immobile while the imaging system determines the location of the adipose fin. Once the adipose fin is located, a clipping mechanism removes the tiny fin. The removal of the fin is confirmed by the control system and the fish is delivered back to the hatchery holding pond.

If the fin is not completely removed, the fish is directed into a holding area to be reprocessed. All this is completed in a matter of seconds and the fish never leaves the water.

Modern computer-assisted trailers have greatly increased the viability and cost-effectiveness of modern mass marking and CWT techniques.

#### How PIT Works

While not used as widely as the CWT, the Passive Integrated Transponder (PIT) tag, enables researchers to gather data on specific fish movements. More specifically, PIT tags allow researchers to record how long it takes migrating juvenile salmon and steelhead to move from release at the hatchery to detection points, such as dams on the Snake and Columbia Rivers. This information

allows managers to refine fish release strategies and dam operations to provide the optimum conditions for the juveniles to migrate through the dams on their way to the ocean.

The tag consists of an integrated microchip bonded to an antenna coil. These electronic components are encapsulated in a glass tube, uniquely coded, and come in various lengths.

The tags are individually hand loaded into 12 gauge veterinary grade hypodermic needles then injected into the body cavity of the juvenile fish.



USFWS, Jesse Rivera



PIT injection / USFWS, Jesse Rivera

The PIT process is usually performed in trailers, similar to conventional CWT trailers. However, they are fitted with manual tagging stations. The U.S. Fish and Wildlife Service injects PIT tags into more than 100,000 fish annually.

#### Application Costs and Benefits

Mass marking by removing the adipose fin is the least expensive marking method described in this brochure. Coded-wire tagging costs about four times more than mass marking and PIT tagging costs about thirty times more than coded-wire tagging.

The application of these technologies at our hatcheries helps fishery managers track and manage fish to provide for the protection and recovery of wild fish while maximizing commercial and sport use of hatchery fish.

#### For more information, contact:

Marking and Tagging Program  
Western Washington  
Fish and Wildlife Office  
360/753 9440

Columbia River Fisheries  
Program Office  
360/604 2500

Also: <http://www.ptagis.org> and  
<http://www.nmt.us>



# Mass Marking, Coded Wire Tagging, and Passive Integrated Transponder Tagging of Salmon and Steelhead *at National Fish Hatcheries*



Coded wire tag (CWT) application  
Northwest Marine Technology, Inc.



Passive integrated transponder (PIT)/USFWS, Jesse Rivera