

Trapper Creek PIT tagging and mark-recapture population estimate, June, 2005

Oregon Department of Fish and Wildlife
Native Fish Investigations Project

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Background

During late June, 2005, Oregon department of Fish and Wildlife (ODFW), U. S. Forest Service (USFS), U. S. Fish and Wildlife Service (USFWS) and ODFW volunteers worked cooperatively to complete the first phase of a multi-year PIT (passive integrated transponder) tagging/mark-recapture study in Trapper Creek (tributary to Odell Lake). The results of this effort are summarized in the following memo.

Methods

Mark-release phase

The goal of the "mark-release" phase was to capture and clip the upper caudal fin of all bull trout and suspected bull/brook trout hybrids ≥ 80 mm (FL); and to caudal clip and PIT tag up to 30 bull trout and up to 20 suspected bull/brook trout hybrids ≥ 120 mm (FL) within the entire 1.3 kilometer (0.8 miles) of Trapper Creek currently considered accessible to bull trout.

Fish capture method

According to information obtained during previous surveys, more bull trout reside near the mouth of Trapper Creek than in the upper section. To ensure that we did not PIT tag all 30 bull trout in the lower section, we worked in the upper sections first, then moved down to the mouth. We attempted to capture all bull trout and suspected hybrids ≥ 80 mm (FL) with hand nets while snorkeling at night according to the following procedure:

Snorkelers proceeded upstream, holding a dive light in one hand and a hand net in the other. When an appropriately size bull trout was observed, the snorkeler held the light on it and "herded" the fish until it swam over the top of the net. When the fish moved over the net opening, the net was swiftly lifted straight up and out of the water. The net and fish were then transferred to the "bucket crew" waiting on shore.

Two teams of snorkelers worked simultaneously, one team upstream of the other. Each snorkeler was accompanied by a 2 person bucket crew. Each bucket crew carried three 5 gallon buckets (one to hold any fish judged large enough to injure or consume smaller

fish). Buckets were marked to indicate whether they were being used by the upstream or downstream crew. When a snorkeler captured a fish, he/she would hand the net and fish to the bucket crew and indicate the total number and size classes of all fish observed but not captured.

Bucket crews periodically transferred fish to the tagging crew. One person kept two buckets and stayed with the snorkeler, while the other carried one bucket to the tagging station. The number of fish collected in buckets before transferring to the tagging crew depended on how quickly the snorkelers were capturing fish. Bull trout were not carried around in buckets for more than approximately 10 minutes before they were transferred to the tagging crew. Bucket crews watched fish for signs of stress and frequently refreshed buckets with cold water from the stream.

At the tagging station, one person was designated to take fish from the bucket crews and place them in buckets marked to indicate capture by the “upstream” or “downstream” crew. Any bull trout or suspected bull/brook trout hybrid which appeared injured or stressed was immediately released.

Marking methods

The designated data taker recorded the species, length, PIT tag code (if tagged) and fin clip ID number (if clipped) of each fish captured. Captured fish were anesthetized with a diluted mixture of tricaine methanesulfonate (MS-222) buffered 1:1 with sodium bicarbonate. Anesthetized fish were placed on a wetted measuring board and measured to the nearest mm (FL). All bull trout ≥ 80 mm (FL) were marked with an upper caudal clip as follows:

Oregon Department of Fish and Wildlife (ODFW) staff experienced with the caudal clipping procedure used clean, sharp stainless steel scissors to clip a small piece (approximately 2mm^2) of tissue from the upper caudal fin. Fin tissue was placed in pre-labeled vials containing 95% ethanol to preserve them for genetic analysis.

A total of 29 bull trout and 1 suspected bull/brook trout hybrid ≥ 120 mm (FL) were surgically implanted with 23 mm half-duplex PIT tags and marked with an upper caudal clip as follows:

Measured fish were placed ventral side up on a clean, wetted foam block. ODFW staff experienced with PIT tag surgery used a sterile scalpel blade to make a small incision (approximately 3 to 4 mm long) in the ventral side, slightly to one side the midline, anterior to the tip of the pectoral fins. A sterile 23 mm PIT tag was inserted straight into the incision and then angled steeply so that the tag slid into the body cavity (between the body wall and the viscera). The incision was closed with a sterile suture, dried with sterile absorbent gauze and a small drop of veterinary grade tissue adhesive was applied to the wound and suture knots. When the PIT tag surgery was complete, a small piece of tissue was clipped from the upper caudal fin according to the previously described procedure. Throughout the surgical procedure, ODFW staff experienced with the process used a basting dropper to irrigate the gills with diluted anesthetic. When the surgery was nearly complete, gills were irrigated with fresh (non-anesthetized) water until the fish regained some movement and was gilling strongly.

Recovering fish were placed into buckets marked to indicate the section where they were captured (upstream or downstream). Recovery buckets were filled with fresh, cold, aerated stream water fortified with Stress Coat water conditioner. Small fish were separated from larger fish at all times. Fish were held in recovery buckets for approximately 15 minutes. When the last fish was placed in a recovery bucket, the individual assigned to monitor the recovery buckets tied a piece of flagging with the time written on it to the bucket handle. The bucket was then set aside until all fish fully recovered. The number of fish placed in a recovery bucket before it was set aside depended on how quickly capture and tag operations were proceeding. Fish were not held in recovery buckets for more than about 20 minutes prior to being released into the approximate locations where they were captured (upstream fish were released by the upstream bucket crew and vice-versa) downstream of where the snorkelers were working.

Recapture phase

The goal of the “recapture” phase was to count all marked and unmarked bull trout, brook trout and suspected hybrids within the entire 1.3 km (0.8 miles) of Trapper Creek currently considered accessible to bull trout.

Recapture methods

Two teams of snorkelers worked simultaneously, one team upstream and one downstream. Each snorkeler was accompanied by a 2 person bucket crew. Bucket crews followed the snorkelers upstream. Each bucket crew carried one 5 gallon bucket, a small dipnet and a field notebook. Snorkelers counted all fish observed and periodically relayed information pertaining to the species, size class and mark status of all fish observed to the bucket crew. All information was recorded in a field notebook.

Snorkelers attempted to capture any bull trout or hybrid which could not be easily identified as marked or unmarked. Captured fish were transferred to the bucket handlers for closer observation. Any fish with questionable mark status which could not be captured were recorded as “unknown.” All captured fish were carried approximately 100 feet downstream and released into a quiet area of the stream.

Population estimate

The Peterson mark-recapture method was used to calculate a population estimate for bull trout ≥ 80 mm (FL) as follows:

$$N = [(M + 1) (n + 1) / R + 1] - 1$$

Where M = the number of fish marked, n = the number captured in the second sample and R = the number of marked fish recaptured.

Standard Error (SE):

$$SE = \sqrt{(M + 1) (n + 1) (M - R) (n - R) / (R + 1)^2 (R + 2)}$$

95% confidence intervals:

$$N \pm (t) (SE)$$

Where t is Student's t for DF (degrees of freedom) = ∞

All formulas were obtained from Brower *et al* 1997.

Retrieving/storing PIT tag data

A pit tag antenna will be installed near the mouth of Trapper Creek during fall, 2005. Data collected during the mark-release phase and data recorded by the PIT tag antenna will be stored in an Access database.

Results

Mark-release phase

Mark-release operations were conducted between 6/21/05 and 6/23/05. During the mark-release phase, snorkelers observed a total of 94 bull trout \geq 80 mm (FL), 36 bull trout < 80 mm (FL), 3 suspected bull/brook trout hybrids < 80 mm, 2 suspected bull/brook trout hybrids \geq 80 mm, 3 brook trout \geq 80 mm and 23 rainbow trout. Captured fish are summarized in Table 1.

Table 1. Minimum, maximum and mean fork lengths of all fish captured during the "mark-release" phase.

Species	Number captured	Min length (mm)	Max length (mm)	Ave length (mm)
Brook trout	1	122	122	122
Bull trout	64	55	225	123
Bull/brook hybrids	1	143	143	143
Rainbow trout	2	87	118	103

Genetic samples were taken from 59 bull trout, 1 suspected bull/brook hybrid and one brook trout. Twenty-nine bull trout and one suspected bull/brook hybrid \geq 120 mm (FL) were surgically implanted with 23 mm half-duplex PIT tags (see tables 2 and 3).

Table 2. Fork lengths and tag codes recorded for all bull trout and suspected bull/brook trout hybrids PIT-tagged during the "mark-release" phase.

Species	Length (mm)	Pit tag code
Bull trout	158	132591114
Bull trout	129	132591115
Bull trout	135	132591116
Bull trout	129	132591117
Bull trout	127	132591118
Bull trout	185	132591119
Bull trout	174	132591120

Species	Length (mm)	Pit tag code
Bull trout	134	132591123
Bull trout	130	132591124
Bull trout	143	132591125
Bull trout	142	132591146
Bull trout	225	132591147
Bull trout	126	132591148
Bull trout	156	132591149
Bull trout	180	132591150
Bull trout	120	132591151
Bull trout	216	132591152
Bull trout	165	132591153
Bull/brook hybrid	143	132591154
Bull trout	159	132591155
Bull trout	186	132591156
Bull trout	135	132591157
Bull trout	176	132591158
Bull trout	120	132591160
Bull trout	125	132591161
Bull trout	153	132591162
Bull trout	165	132591283
Bull trout	120	132591284
Bull trout	134	132591285
Bull trout	120	132591286

Table 3. Minimum, maximum and mean fork lengths of all bull trout and suspected bull/brook trout hybrids PIT tagged during the “mark-release” phase.

Species	Min length (mm)	Max length (mm)	Ave length (mm)
Bull trout	120	225	151
Bull/brook hybrid	143	143	143

Recapture phase

The recapture effort was conducted on 6/27/05 and 6/28/05. Eighty-nine bull trout ≥ 80 mm and 58 bull trout < 80 mm were observed during the “recapture” phase (see table 4). One suspected bull/brook trout hybrid (unmarked), 3 unmarked brook trout and 41 rainbow trout were also observed. Of bull trout ≥ 80 mm observed, 29 bore upper caudal clips, 55 were unmarked and 5 were designated “unknown” (see table 4). Eight bull trout were captured for verification of mark status.

Table 4. All bull trout observed during “recapture” phase.

Mouth of Trapper creek to campground bridge 6/27/05																			
# Unmarked observed					# Marked observed					# Unknown observed					Total number marked				
0+	1+	2+	3+	Total ≥ 80 mm	0+	1+	2+	3+	Total ≥ 80 mm	0+	1+	2+	3+	Total ≥ 80 mm	0+	1+	2+	3+	Total ≥ 80 mm marked
42	11	12	0	23	0	3	8	3	14	0	4	0	0	4	2	10	14	3	27

Campground bridge to railroad bridge 6/28/05																			
# Unmarked observed					# Marked observed					# Unknown observed					Total number marked				
0+	1+	2+	3+	Total ≥ 80 mm	0+	1+	2+	3+	Total ≥ 80 mm	0+	1+	2+	3+	Total	0+	1+	2+	3+	Total ≥ 80 mm marked
14	19	7	1	27	0	6	3	5	14	0	0	0	0	0	0	17	3	5	25

Railroad bridge to falls 6/28/05																			
# Unmarked observed					# marked observed					# Unknown observed					Total number marked				
0+	1+	2+	3+	Total ≥ 80 mm	0+	1+	2+	3+	Total ≥ 80 mm	0+	1+	2+	3+	Total ≥ 80 mm	0+	1+	2+	3+	Total ≥ 80 mm marked
2	4	1	0	5	0	0	0	1	1	0	1	0	0	1	0	1	3	1	5

Population estimate

$$N = [(57+1)(84+1)/(29+1)] - 1$$

$$N = [(58)(85)/30] - 1$$

$$N = [(4930)/30] - 1 = 163$$

Standard Error (SE):

$$SE = \sqrt{(M+1)(n+1)(M-R)(n-R)/(R+1)^2(R+2)}$$

$$SE = \sqrt{(57+1)(84+1)(57-29)(84-29)/(29+1)^2(29+2)}$$

$$SE = \sqrt{(58)(85)(28)(55)/(30)^2(31)} = 16.5$$

95% confidence interval:

$$N \pm (t)(SE)$$

$$163 \pm (1.96)(16.5) =$$

Population estimate for juvenile bull trout ≥ 80 mm in the lower 1.3 km of Trapper Creek:

163 \pm 32