ANNUAL PROGRESS REPORT

PROJECT TITLE: Native Trout Studies

PROJECT NUMBER: F-136-R-14

CONTRACT PERIOD: 1 October 2000 to 30 September 2001.

Prepared by: A. R. Hemmingsen
and
S. J. Starcevich

Oregon Department of Fish and Wildlife
Fish Division
P.O. Box 59
Portland, Oregon 97207

This project was financed in part by the Sport Fish and Wildlife Restoration Program that is administered by the U.S. Fish and Wildlife Service.

Native Trout Studies

I. **Summary**: We radio-tagged 34 adult westslope cutthroat trout in Rail Creek and Roberts Creek in the mainstem John Day River subbasin. These fish were located weekly by telemetry, as were those with active transmitters applied in 2000, to determine seasonal movements. Habitat measurements were collected at each re-location of each radio-tagged fish to determine their seasonal habitat preferences. We collected tissue samples from westslope cutthroat trout and rainbow trout in two streams for genetic description of the populations, and to determine the extent of hybridization between the two species. We helped survey Davis Creek, tributary to the Middle Fork John Day River, to determine whether bull trout were present.

II. **Background**: The goal of this project is to provide fish managers and landowners with scientific information to develop protection strategies for Oregon's native trout. These strategies will help the Oregon Department of Fish and Wildlife (ODFW) implement fish management goals, subbasin plans, the Native Fish Conservation Policy, and the Oregon Plan for Salmon and Watersheds. Protection strategies for Oregon's native trout are also needed to insure present and future recreational angling benefits. Native Trout Studies is an ongoing project within ODFW intended to further the understanding of the biology of Oregon's native trout. Project personnel also provide technical assistance to ODFW staff and managers as needed.

In recent years, the Native Trout project has conducted studies of native bull trout *Salvelinus confluentus*, westslope cutthroat trout *Oncorhynchus clarki lewisi*, and redband trout *O. mykiss* trout within the John Day Basin (Hemmingsen 2000; Hemmingsen and Starcevich 2000). Bull trout have been placed on the endangered species list by the U.S. Fish and Wildlife Service. Redband trout and westslope cutthroat trout were also proposed for endangered species listing in the 1990s. Since native trout thrive in pristine environments, they have been compromised by the human alteration or depletion of aquatic and riparian habitat. Destructive changes in trout habitat can result from a variety of sources. The riverine environment in the John Day Basin has been altered by decades of livestock grazing, water diversion for irrigation, agricultural development, channelization, dredge mining, the near-elimination of beaver, and headwater timber harvest (Wissmar *et al*. 1994). *O. clarki* from the Yellowstone Hatchery were reportedly introduced in the upper mainstem John Day River in the 1920s and 30s. The hatchery produced both Yellowstone and westslope cutthroat trout and the subspecies released in Oregon is uncertain. Both hatchery rainbow trout *O. mykiss* and nonnative brook trout *S. fontinalis* have been introduced in the John Day River, and there is evidence of hybridization between westslope cutthroat trout and rainbow trout (Hemmmingsen 2000, Appendix A).

Currently, the vast majority of viable, self-sustaining westslope cutthroat trout populations are in steep, high-elevation, forested, headwater basins on publicly owned land. Headwater basins generally experience the most extreme seasonal fluctuations in discharge and temperature in a stream network (Schlosser 1995). Adapting to these seasonal changes, westslope cutthroat trout and other potamodromous salmonids have evolved complex and diverse life histories (Schlosser 1995; Northcote 1997). Because life history is determined by genotype, phenotypic plasticity of the organism,

environmental history, and the availability of critical habitats across a template, life history adaptations in headwater basins can be viewed from a habitat perspective (Southwood 1977; Healey and Prince 1995). We have initiated studies of the life history requirements of westslope cutthroat trout in headwaters of the main stem John Day River through description of seasonal habitat associations identified by radio telemetry (Hemmingsen and Starcevich 2000). This will help prioritize the restoration and management of increasingly fragmented habitats.

III. **Objectives**:

A. Radio tag 30 westslope cutthroat trout in Roberts Creek and Rail Creek of the upper mainstem John Day River subbasin and monitor their movements weekly. Continue to monitor weekly movements of 41 cutthroat trout tagged in 2000.

B. Determine characteristics of seasonal habitats of radio-tagged westslope cutthroat trout.

C. Collect tissue samples for genetic analysis to confirm the subspecies of *O. clarki* in the John Day Basin, determine the extent of hybridization between *O. clarki* and *O. mykiss*, and determine whether resident *O. mykiss* have genetic characteristics of coastal stocks.

D. Assist with coordinated, multi-agency investigations of the summer distribution and abundance of bull trout in the Middle Fork John Day River subbasin.

IV. **Procedures**:

Objective A.

In order to describe seasonal habitat associations and movements, cutthroat trout in Roberts Creek and Rail Creek were captured by fly-fishing and surgically implanted (inter-peritoneal) with radio transmitters (3.6 g) that had expected battery life of 280 days. Since we wanted the weight of the transmitter to be less than 4% of the weight of the fish, we chose cutthroat trout that were at least 20 cm fork length. Each radio-tagged fish was also identified with a 14-mm passive integrated transponder (PIT) tag at 125 KHz (Avid) placed in the peritoneal cavity during surgery. Only fish with phenotypic characteristics reported to describe westslope cutthroat trout were selected for implantation of radio tags. To validate our assessment of phenotypic characters, we also collected samples of caudal fin tissue from each radio-tagged fish. These samples were stored in ethanol for future determination of genetic characteristics by DNA analysis. Each radio-tagged cutthroat trout was located weekly by streamside telemetry using a receiver (Lotek) and hand-held antenna (White and Garrot 1990). Distances moved were measured by tape or referenced to marked flagging placed at 100-m intervals.

Objective B.

Habitat was measured at the channel unit scale (e.g., pools, riffles, and rapids) at each re-location of a radio-tagged fish. Habitat characteristics measured included unit type, dimensions, structural association, gradient, canopy cover, undercut banks, overhanging vegetation, and boulder count. The volume and in-stream location of large wood was

also estimated. Habitat inventories were conducted throughout 11.8 km of Roberts Creek and Rail Creek combined between August and November 2001 using the methods of Moore et al. (2000). These inventories included measurements of the same habitat characteristics described at each fish location. Reach-scale habitat characteristics, including valley geomorphology, channel constrainment, riparian vegetation, and land use were also measured. Hourly stream temperatures were collected with thermographs located at 1-km intervals in both creeks (six thermographs per creek) and at selected locations in the mainstem John Day River. Stream discharges of Roberts Creek and Rail Creek were measured weekly near their mouths with staff gauges calibrated with a flow meter.

Objective C.

We sampled fish from three distribution zones in Bear Creek and the upper mainstem John Day River. Distribution zones were allopatric for *O. clarki*, allopatric for *O. mykiss*, and sympatric for both species. Thirty tissue samples (caudal fin clips) were collected for DNA analysis within each zone. These 30 samples within zones were collected from 10 fish in each of three reaches. Thirty allopatric *O. clarki* in each stream were collected for allozyme and DNA analysis. Fish in Bear Creek were captured by electrofishing while fish of the John Day River were captured by angling. All samples were sent to the Wild Trout and Salmon Genetics Lab at the University of Montana for analysis, with funding provided by the U.S. Forest Service (USFS). Morphometric measurements were collected on all sampled fish for comparison with genotypic characteristics.

The intent of this objective is to provide a genetic description of *O. clarki* and resident *O. mykiss* in 10 streams in the John Day Basin. It is part of a broader study by USFS to also provide a genetic description of *O. clarki* and resident *O. mykiss* in six Washington subbasins. Sampling in Oregon streams began in 1999 and concluded with sampling described here in 2001.

Objective D.

Investigations of the summer distribution and abundance of bull trout in the Middle Fork John Day River subbasin continued in 2001. Sampling activities were coordinated by ODFW biologists at the John Day district office, who received field assistance from biologists with the U.S. Forest Service, the Oregon Department of Transportation, and Native Trout Studies as well as volunteers from the public. Davis Creek was sampled during July 24-26 to determine whether bull trout were present. Sampling was conducted according to an interim protocol developed by the Western Division American Fisheries Society (WDAFS) Bull Trout Committee to determine bull trout occurrence (Peterson et al. 2000), with modifications from regional field trials in 2000.

The protocol establishes sampling intensity based on estimated sampling efficiencies that are habitat specific, and on expectations derived from documented bull trout densities. Habitat characteristics expected to occur in Davis Creek suggested that 24 sample units 50 m long were needed to detect bull trout with 80% confidence. These sample units were randomly selected from all possible units existing throughout the length of Davis Creek. Map coordinates of the selected units were used to locate sampling sites in the field using GPS.

At each GPS location, a sample reach was measured upstream for 50 m and constrained with blocking nets. We captured fish by electrofishing three passes between blocking nets, moving upstream only. At 10-m intervals starting at the downstream net,

we measured: 1) the wetted and bank-full width of the stream; 2) depth at three locations; 3) maximum depth; 4) gradient; 5) type and amount of large wood; and 5) length and width of undercut banks.

V. **Findings**:

Objective A.

We applied 30 new radio transmitters to westslope cutthroat trout in 2001, and four other transmitters that were recovered from previously tagged cutthroat trout. Of these fish, 17 were from Roberts Creek and 17 were from Rail Creek. Radio-tagged cutthroat trout were between 20 and 29 cm fork length (Table 1). Implanted transmitters ranged from 1.4 to 3.9% of the body weight of their hosts. The maximum number of radio-tagged fish that were tracked any single month was 52. This occurred during May, when 18 transmitters applied in February were tracked along with transmitters applied in 2000 that remained active.

Preliminary analysis of movements of radio-tagged westslope cutthroat trout showed differences among individuals and seasons. Among individuals in a single month, net movement ranged from 3 to 3,187 m. There also appeared to be seasonal differences in median distance moved. Radio-tagged fish in both Roberts Creek and Rail Creek moved the greatest median distances (226 m and 832 m, respectively) in spring and the lowest median distances (10 m and 5 m, respectively) in winter. In Roberts Creek, 92% of the radio-tagged fish moved in May while only 10% moved in December. In Rail Creek, 86% of radio-tagged fish moved in May while 37% moved in December.

Objective D.

In Davis Creek, 24 randomly selected sample units 50 m in length were surveyed and no bull trout was detected. Other salmonids that were present included 599 rainbow trout and four juvenile chinook salmon. Additional information regarding rainbow trout abundance and density as well as stream habitat characteristics may be presented in ODFW John Day district reports.

Table 1. Characteristics of cutthroat trout of the upper John Day subbasin implanted with radio transmitters during 2001.

Location, Date tagged	FL (cm)	W (g)	Transmitter Ratio[a]	Transmitter Duration (d)	Transmitter Frequency (MHz)
Roberts Cr:					
20 Feb	21.9	118	0.0305	280	151.375
20 Feb	25.0	136	0.0265	280	150.684
21 Feb	28.0	250	0.0144	280	151.451
21 Feb	26.0	184	0.0196	280	151.622
21 Feb	24.5	154	0.0234	280	150.525
22 Feb	25.2	167	0.0216	280	150.145
22 Feb	21.9	104	0.0346	280	151.643
22 Feb	23.3	126	0.0286	280	150.663
23 Feb	20.1	92	0.0391	280	150.323
23 Feb	24.3	146	0.0247	280	150.122
19 Jun	24.2	150	0.0240	280	150.723
19 Jun	23.6	146	0.0247	280	151.473
19 Jun	23.5	132	0.0273	280	151.662[b]
20 Jun	22.6	124	0.0290	280	150.993
20 Jun	20.9	100	0.0360	280	150.164
20 Jun	22.1	100	0.0360	280	150.183
12 Sep	27.4	228	0.0158	280	151.473[b]
Rail Creek:					
26 Feb	23.9	158	0.0228	280	150.300
26 Feb	27.4	216	0.0167	280	150.382
26 Feb	23.9	136	0.0265	280	150.102
27 Feb	28.3	222	0.0162	280	151.683
27 Feb	22.3	114	0.0316	280	151.662
28 Feb	26.5	174	0.0207	280	150.583
28 Feb	25.9	184	0.0196	280	150.701
28 Feb	28.6	224	0.0161	280	151.702
01 Mar	23.8	130	0.0277	280	151.433
21 Jun	20.6	110	0.0327	280	151.412
21 Jun	21.7	132	0.0273	280	150.742
21 Jun	28.4	246	0.0146	280	150.763
21 Jun	23.5	130	0.0277	280	150.382[b]
25 Jun	24.0	150	0.0240	280	150.893
25 Jun	26.6	226	0.0159	280	150.084
25 Jun	22.0	116	0.0310	280	151.392
12 Sep	28.9	256	0.0141	280	150.323[b]

[a] Transmitter weight : fish weight ratio.
[b] Transmitters that were recovered and implanted in other fish.

VI. **References**:

Brown, R.S., and W.C. Mackay. 1995. Fall and winter movements and habitat use by cutthroat trout in the Ram River, Alberta. Transactions of the American Fisheries Society **124**:873-885.

Healey, M.C., and A. Prince. 1995. Scales of variation in life history tactics of Pacific salmon and the conservation of phenotype and genotype. American Fisheries Society Symposium **17**:176-184.

Hemmingsen, A. 2000. Native Trout Studies, 1999 Annual Progress Report. Project F-136-R-12, Sport Fish Restorations, U.S. Fish and Wildlife Service, Portland, Oregon.

Hemmingsen, A. and S. Starcevich. 2000. Native Trout Studies, 2000 Annual Progress Report. Project F-136-R-13, Sport Fish Restorations, U.S. Fish and Wildlife Service, Portland, Oregon.

Moore, K.M.S., K.K. Jones, and J.M. Dambacher. 2000. Methods for stream habitat survey. Oregon Department of Fish and Wildlife Information Report 97-4, Portland, OR.

Northcote, T.G. 1997. Potamodromy in Salmonidae – living in the fast lane. North AmericanJournal of fisheries Management **17**:1029-1045.

Peterson, J., J. Dunham, P. Howell, S. Bonar, R. Thurow. 2000. Interim protocol for determining bull trout presence. American Fisheries Society, Western Division.

Schlosser, I.J. 1995. Critical landscape attributes that influence fish population dynamics in headwater streams. Hydrobiologia **303**:71-81.

Southwood, T.R.E. 1977. Habitat, the templet for ecological strategies? Journal of Animal Ecology **46**:337-367.

White, G.C., and R.A. Garrot. 1990. Analysis of wildlife radio-tracking data. Academic Press, San Diego, California, USA.

Wissmar, R.C., J.E. Smith, B.A. McIntosh, H.W. Li, G.H. Reeves, and J.R. Sedell. 1994. A history of resource use and disturbance in riverine basins of eastern Oregon and Washington (Early 1800s-1990). Northwest Science **68**:1-35.

VII. **Plans for 2001-02**:

A. Continue to monitor movements of radio-tagged adult westslope cutthroat trout in Roberts Creek and Rail Creek whose transmitters have not expired. Analyze seasonal movements (distance and direction) of cutthroat trout radio-tagged in both 2000 and 2001.

B. Analyze seasonal habitat associations of adult westslope cutthroat trout in Roberts Creek and Rail Creek. Habitat data will be grouped by season (e.g., summer, winter, and spring), which will be defined by the end of distinct seasonal movements (Brown and Mackay 1995) or by seasonal differences in stream temperature and discharge. The seasonal mean of a habitat variable will be compared with the availability of the variable. Seasonal habitat preferences will be calculated and compared.

C. Assess the influence of the spatial distribution of habitat patches on movement of westslope cutthroat trout.

VIII. A total of $140,394 was spent on Native Trout Studies during FY 2002. Because of unexpected savings in services and supplies, $3,700 was re-allocated to personnel services to balance unanticipated costs.

IX. **Acknowledgements**:

We are grateful to the following individuals: David and Lisa Gaudette and Kristen Gorman for assistance with habitat inventories; Paul Sankovich, Jason Seals and John Brunzell for assistance with capture of cutthroat trout and implantation of radio tags; Jason Seals and Jeff Neal for capture of cutthroat and rainbow trout for genetic analyses; and Kim Jones and Bruce McIntosh for the use of their field equipment.