STATE OF OREGON 1859
NEIL GOLDSCHMIDT
GOVERNOR

Department of Fish and Wildlife

506 SW MILL STREET, P.O. BOX 59, PORTLAND, OREGON 97207

6-13-89

Dear Dr. Behnke,

Enclosed is the report you requested. I also found this ad in the Oregonian last week and I'm sure this is McIntyre. The logo is a dead give away. Also of interest is the new license surcharge which will fund several major projects for a number of years. These funds will generate a number of positions that should be sent to your department to announce application dates.

I was unsuccessful in obtaining a deer permit to hunt in the Trout Creek drainage but will try each year until successful. The success rate for being selected in this area is about 10%.

While I'm at it I will enclose a copy of reports I generate for our staff & anglers.

Best,

Charlie

[1989]

License surcharge to enhance fish programs

SALEM — The Legislature gave final passage Friday to increase fees on fishing licenses to pay for programs aimed at restoring runs and improving habitat of fish.

The Senate voted 21-8 to send Gov. Neil Goldschmidt the measure establishing a $2 surcharge on the resident angling license. The cost of resident licenses will increase from $12.50 to $14.50.

The measure also will raise the fees for resident juvenile angling licenses from $4.50 to $5.50; resident combination hunting and fishing licenses from $19.50 to $21.50; non-resident annual angling licenses from $30.50 to $35.50.

The new law also will increase the cost of temporary fishing privileges from $4 to $5 for one-day licenses; and from $18.50 to $21 for 10-day non-resident angling licenses.

The increased fees will raise $3.1 million over the next two years, and it will be used to improve hatcheries and fresh-water habitat.

The measure also will establish a seven-member Restoration and Enhancement Board to recommend fish-related programs to the Fish and Wildlife Commission.

The measure also would double the current 5 cents per pound fee paid by about 3,000 commercial salmon fishermen for trolling in the ocean and using gill nets in the Columbia River. The cost of commercial salmon trolling permits, and Columbia River gill-net permits will increase to $75. The permits now cost $10 and $1, respectively.

Shrine game advanced 1 week

The North-South Shriners Hospital All-Star Football Game to be played in Civic Stadium has been moved up a week and will be played at 7 p.m. July 29.

Budd Burnie, general chairman of the event, said the date change was a result of the Trail Blazers' desire to move their rookie game and slam-dunk contest to Civic Stadium from Memorial Coliseum this year. Those events are scheduled for Aug. 5.

"They asked if we would agree to changing the date of our game, and we agreed to do that," Burnie said.

Burnie also said the game, which had been known as the Oregon Shrine Bowl for the past two years, will revert to its traditional name this year. That allows the game to emphasize its purpose as a benefit for the Shriners Hospital for Crippled Children and also the geographical makeup of the teams, he said.

The game matches graduated seniors from Class AAA high schools throughout the state. The North team is made up of players selected from metropolitan Portland schools and the South team is composed of players from the remainder of the state.

70-79—149 +5
72-77—149 +5

s Invitational

ts CC, Vancouver, Wa.
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72, Paul Campbell 72, Robert
cker 73, Brad Schadewitz 73;
76-7—69.
SENIOR DIVISION
ratto 70, Dick Iverson 72, Jon
Wayne McDonald 79-13—66.
IOR DIVISION
ite 71, Spike Beeber 73, Bruce
kin Brown 77-9—68.

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OCCER

occer League

RTH DIVISION

	W	L	Pts	GF	GA
	6	3	59	22	15
	5	2	44	16	9

Grand Prix of Cycling

At Indianapolis
MEN'S KEIRIN QUALIFYING
(Top 3 each heat to finals)

HEAT 1 — 1, Bobby Livingston, Riverdale, Ga., 11.81. 2, Shaun Wallace, England. 3, Nelson Vails, Indianapolis. 4, Gene Samuel, Trinidad.

HEAT 2 — 1, Curt Harnett, Canada, 12.07. 2, Richard Young, Canada. 3, Gibby Hatton, Alburtis, Pa. 4, Brian McDonough, Largo, Fla.

HEAT 3 — 1, Michel Vaarten, Belgium, 11.45. 2, Erin Hartwell, Indianapolis. 3, Mark Gorski, Newport Beach, Calif. 4, Mario Pons, Ecuador.

WOMEN'S MATCH SPRINT
QUARTERFINALS

Winner of each heat advances to best-of-three semifinals — **HEAT 1**, Connie Paraskevin Young, Indianapolis, def. Lisa Giuffre, Englewood, Ohio. **HEAT 2**, Julie Speight, Australia, def. Bonnie Blair, Butte, Mont. **HEAT 3**, Lucy Tyler, Largo, Fla., def. Karen Bliss, State College, Pa. **HEAT 4**, Debra Cohen, Northbrook, Ill. def. Barbara Gradley, Westwood, N.J.

MEN'S PURSUIT
Four Fastest Advance

1, Shaun Wallace, England, 4:49.11. 2, Mindaugas Umares, Soviet Union, 4:49.77. 3, Remigijus Lupeikis, Soviet Union, 4:51.15. 4, Adias Klimavicius, Soviet Union, 4:54.60. 5, Carl Sundquist, Miami, Fla., 4:56.74. 6, Erin Hartwell, Indianapolis, 5:05.38.

WOMEN'S PURSUIT
Four Fastest Advance

1, Lucy Tyler, Largo, Fla., 4:02.04. 2, Mindee Mayfield, Evergreen, Colo., 4:03.35. 3, Peggy Maass, Colorado Springs, Colo., 4:06.84. 4, Karen Bliss, State College, Pa., 4:12.82. 5, Barbara Gradley, Westwood, N.J., 4:18.08. 6, Traci Johnson, Indianapolis, 4:36.62.

MEN'S MATCH SPRINT
Quarterfinals

Winner of each heat advances to best-of-three semifinals — Heat 1, Curt Harnett, Canada, def. Tony Ward, Canada. Heat 2, Steve Phillips, Houston, def. Bobby Livingston, Riverdale, Ga. Heat 3, Nelson Vails, Indianapolis, def. Mark Gorski, Newport Beach, Calif. Heat 4, Richard Young, Canada, def. Michel Vaarten, Belgium.

MATCH SPRINT SEMIFINALS

Men — Harnett vs. Young, Vails vs. Phillips.
Women — Young vs. Cohen, Tyler vs. Speig

MEN'S 100-LAP POINTS
FINAL

1, Remigijus Lupeikis, Soviet Union, 38 points. 2, Brian McDopnough, Largo, Fla., 20. 3, Arturas Trumpaaskas, Soviet Union, 16. 4, Mindaugas Umares, Soviet Union, 11. 5, Arturas Kasputis, Soviet Union, 10. 6, Naglis Cipligaushas, Soviet Union, 6.

WRESTLING

Pro wrestling

At Portland Sports Arena
Saturday, 8:30 p.m.

MAIN EVENTS—Billy Jack returns to the Sports Arena ring against The Grappler; Kangaroo Jonathan Boyd vs. Steve Doll; Scott Peterson vs. Scotty The Body.

OTHER EVENTS — Al Madril vs. Beetle Juice; Joey Jackson vs. Top Gun; Midnight Soldier vs. Col. De Beers.

TENNIS

French Open

At Paris
MEN'S SINGLES
SEMIFINALS

Michael Chang (15), Placentia, Calif., def. Andrei Chesnokov, Soviet Union, 6-1, 5-7, 7-6 (7-4), 7-5.

Stefan Edberg (3), Sweden, def. Boris Becker (2), West Germany, 6-3, 6-4, 5-7, 3-6, 6-2.

WOMEN'S DOUBLES
SEMIFINALS

Steffi Graf, West Germany, and Gabriela Sabatini, Argentina, (3), def. Jana Novotna and Helena Sukova, Czechoslovakia (1), 6-1, 6-2.

Larissa Savchenko and Natalia Zvereva, Soviet Union (2), def. Brenda Schultz, Netherlands, and Andrea Temesvari, Hungary, 6-1, 6-4.

MIXED DOUBLES
SEMIFINALS

Manon Bollegraf and Tom Nijssen, Netherlands (3), def. Robin White, San Jose, Calif., and Jim Grabb, Tucson, Ariz. (2), 6-1, 7-5.

Arantxa Sanchez, Spain, and Horacio De la Pena, Argentina, def. Zina Garrison, Houston, and Rick Leach, Laguna Beach, Calif., 7-6 (7-5), 4-6, 11-9.

kee, walkover.

Dan Goldie, McLean, Va., def. Gary Muller, South Africa, 7-6 (7-5), 6-7 (5-7), 6-3.

Byron Talbot, South Africa, def. Derrick Rostagno, Brentwood, Calif., 6-7 (4-7), 6-3, 7-5.

QUARTERFINALS

Brod Dyke, Australia, def. Piet Norval, South Africa, 7-6, 1-1, retired.

John McEnroe, Cove Neck, N.Y., def. Dan Goldie, McLean, Va., 7-5, 6-4.

Paul Annacone, Bridgehampton, N.Y., def. Christo van Rensburg, South Africa, 7-6 (7-5), 7-5.

Byron Talbot, South Africa, def. Simon Youl, Australia, 7-6 (7-5), 6-7 (3-7), 6-4.

WOMEN'S SINGLES
THIRD ROUND

Catarina Lindqvist, Sweden, def. Anne Simpkin, Britain, 2-6, 6-4, 8-6.

Ronni Reis, North Miami Beach, Fla., def. Jo Louis, Britain, 6-4, 6-1.

Ros Fairbank, San Diego, def. Meredith McGrath, Midland, Mich., 6-4, 7-6 (7-4).

Louise Field, Australia, def. Donna Faber, Bradenton, Fla., 6-4, 6-2.

Kimiko Date, Japan, def. Katie Rickett, Britain, 6-4, 6-1.

Julie Salmon, Britain, def. Kristine Radford, Australia, 5-7, 6-3, 7-5.

Etsuko Inoue, Japan, def. Sandy Collins, Odessa, Texas, 6-4, 7-6 (7-4)

Anne Minter, Australia, def. Karen Schimper, South Africa, 6-4, 6-3.

QUARTERFINALS

Ronni Reis, North Miami Beach, Fla., def. Catarina Lindqvist, Sweden, 4-6, 6-3, 6-3.

Ros Fairbank, San Diego, def. Louise Field, Australia, 7-5, 6-3.

Anne Minter, Australia, def. Etsuko Inoue, Japan, 6-1, 6-1.

Julie Salmon, Britain, def. Kimiko Date, Japan, 3-6, retired.

HORSE RACING

Longacres

FRIDAY, JUNE 9
47th of 125 days
Cloudy, track fast

FIRST — 6 Furlongs. Purse: $4,000.Claiming Price: 4,000. 4-year-olds and up Fillies and Mares.

1. Emma Nola (Comber J) 52.20 38.80 26.20; 3. Ice Cone (Hanna MA) 10.60 6.80; 12. Just For Jack (Barnese VJ) 7.40. T — 1:12 ALSO RAN: Item Five, Ryna's Princess, Miz Moony Lane, One Little Miss Anna Liffey, Grunion Hunt, Asking, Call Me Ruler, Praise Cinch.

SECOND — 6 1-2 Furlongs. Purse: $6,000.Claiming Price: 20,000. Maiden 3-year-olds Colts and Geldings.

10. En Papillote (Corral JR) 27.40 12.20 7.00; 8. Mike The Knife (Cooper B) 8.40 5.80; 11. Klahanie Blue (Gonsalves FA) 3.60. T — 1:18 1-5 $2 DAILY DOUBLE (1-10) paid $519.20 ALSO RAN: Knife River, Monetary Magic, Allaire Dancer, Decidely Best Delightful Devil, Writer, Kungdru, Scar Faux.

THIRD — 6 Furlongs. Purse: $6,100.Claiming Price: 10,000. 3-year-olds Fillies.

5. Krystie C. (Bergsrud SA) 17.00 8.20 7.20; 3. Call Me Ellen (Baze G) 8.60 6.60; 7. Mid Size (Best F) 7.20. T — 1:11 $3 EXACTA (5-3) paid $271.80 ALSO RAN: Holley Nass, Sheenie, Crashcyn Burn, Mas Que Oro Arapahoe Freedom, Katahdin, Cedar Crest Lady.

FOURTH — 1 1-16 Miles. Purse: $5,000.Claiming Price: 16,000. Maiden 3 and 4-year-olds Fillies.

9. In Time To Win (Boulanger G) 7.60 5.00 3.[illegible]0; 4. Drum Bunny (Comber J) 4.40 3.00; 8. Scarey Movie (Mills JW) 2.80. T — 1:46 ALSO RAN: Just Joggin, Buckles N' Bows, Rock A Bi, Renewal Time Thingsyoudoforus, Black Hills Gold.

FIFTH — 6 1-2 Furlongs. Purse: $9,700.Claiming Price: 20,000. 4-year-olds and up Fillies and Mares.

9. Off The Shelf (Boulanger G) 4.20 3.40 2.60; 5. Exit's Baby (Bergsrud SA) 10.00 5.80; 1. Mercona (Gutierrez JA) 6.20. T — 1:16 3-5 $3 EXACTA (9-5) paid $58.20 ALSO RAN: Windy Wine, Night Bunny, Katie Kould, Plentee Chris Lovely Candy, Mio D' One, Bold Avon.

SIXTH — 1 Mile. Purse: $6,000.Claiming Price: 8,000. 4-year-olds and up Fillies and Mares.

5. Mary Mame (Corral JR) 5.80 4.20 3.00; 9. Hot Zee (Boulanger G) 5.00 4.40; 3. Smooth N Lovely (Comber J) 7.00. T — 1:38 4-5 ALSO RAN: Miss High Score, Tia's Wind, Gallant Actress, Clap The Erasers Miss Sailalong.

SEVENTH — 1 1-16 Miles. Purse: $9,100.Claiming Price: 16,000. 4-year-olds and up.

6. Pappy Who (Best F) 8.80 4.40 3.40; 2. Regal's Fool (Gonsalves FA) 9.40 5.80; 5. Acadian Prince (Corral JR) 8.80. T — 1:44 3-5 $3 EXACTA (6-2) paid $99.00 ALSO RAN: Burbank Slew, Wickhersnapp, Running Arkie, Flashy A. J. Robby Le Slew, Sir Tyson, Salute To Slew.

EIGHTH — 6 Furlongs. Purse: $11,700.Claiming Price: 40,000-32,000. 3-year-olds.

8. Nail Bender (Corral JR) 11.60 5.40 3.80; 3. Forgotten Days (Southwick WE) 5.60 4.20; 5. Jackson Hole Blues (Barnese VJ) 4.60. T — 1:09 4-5 $3 DAILY TRIPLE (5-6-8) paid $204.00 ALSO RAN: Lord's Lanes, French Camp Flash, Buffalo Runner, Rayson Feather Walkin' Man.

NC—no change
M—missing

Fish count

Upstream movement of chinook, steelhead, blueback, shad and coho at Columbia and Snake River dams on Thursday:

	CK	CO	BL	ST	SH
Bonneville	424	0	86	193	163,797
The Dalles	427	0	36	58	150,099
John Day	286	0	21	44	77,587
McNary	221	0	4	31	19,015
Ice Harbor	163	0	0	2	225
L. Monumental	154	0	0	1	30
Lower Granite	105	0	0	1	0
Priest Rapids	45	0	2	0	264
Rock Island	96	0	3	0	0
Rocky Reach	14	0	2	0	0
Wells	13	0	0	0	0

Transactions

BASEBALL
American League

KANSAS CITY ROYALS—Sent Stan Clarke, pitcher, to Omaha of the American Association. Recalled Bill Pecota, infielder, from Omaha. Signed Richard Tunison and David King, first basemen; Lance Jennings, David Solseth and Colin Ryan, catchers; Brian Ahern, Matthew Karchner, Chris Schaefer, Clinton Foster, Ben Pardo, Louis Talbert, Andres Berumen, Scott Centala, Michael Webster, Kirk Baldwin, Herbert Milton, Edward Pierce and Bubba Dunn, pitchers; Gary Caraballo and Chris Jones, third basemen; Sean Collins, second baseman; Kirk Thompson and Kevin Long, outfielders; David Ritchie and Javier Alvarex, shortstops, and Darnell Dickerson and Jay Andrews, outfielders.

National League

NEW YORK METS—Traded Terry Leach, pitcher, to the Kansas City Royals for a player to be named later. Recalled David West, pitcher, from Tidewater of the International League.

PITTSBURGH PIRATES—Purchased the contract of Miguel Garcia, pitcher, and Dann Bilardello, catcher, from Buffalo of the American Association. Sent Tom Prince, catcher, and Roger Samuels, pitcher, to Buffalo.

ST. LOUIS CARDINALS—Signed Paul Coleman, outfielder, to a minor-league contract and assigned him to Johnson City of the Applachian League.

HOCKEY
National Hockey League

DETROIT RED WINGS—Signed Marc Habscheid, forward.

COLLEGE

CARNEGIE-MELLON—Named Bruce Bronsdon men's and women's swimming coach and director of aquatics.

CHRISTIAN HERITAGE—Announced it will field a men's soccer team beginning with the 1989-90 school year and named Mike Sutliff head coach; named Nick Pellegrino sports information director.

FLORIDA ATLANTIC—Named Tom Loomis men's head basketball coach.

HARVARD—Named John Veneziano director of sports information.

OHIO STATE—Announced that Eli Brewster, basketball guard, has withdrawn from school.

PURDUE—Named Pete Hoener defensive tackle coach. Announced the resignation of Jim Elam, defensive backs coach. Announced the retirement of Buford Byers, associate athletic director for business affairs, effective June 30 and Fred Wilt, women's track and cross-country coach.

Fencing

U.S. National Championships

At Orlando, Fla.
MEN'S EPEE

1, Rob Stull, San Antonio. 2, Jon Normile, New York. 3, **ROBERT MARX, Portland, Ore.** 4, Geoffrey Russell, Venice, Calif. 5, Chris O'Loughlin, Philadelphia. 6, George Masin, New York. 7, John Moreau, San Antonio. 8, Steven Griffiths, Fair Lawn, N.J.

TEAM EPEE

1, San Francisco Halberstadt. 2, Salle Santelli, New Jersey. 3, San Antonio Legends.

WOMEN'S TEAM FOIL

1, Tanner City Fencing Club, Peabody, Mass. 2, New York Fencers Club. 3, Salle Santelli, New Jersey.

Letter of intent

OREGON STATE — Baseball: Jason Carroll, a pitcher from Rex Putnam High School.

PORTLAND
JUN 13 '89
OREG.
P.B. METER
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U.S. POSTAGE
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Ore. Native Trout studies

biodiversity: - hatch time

- disease resist.

FIRST CLASS MAIL

1st draft
2/23/89

ANNUAL PROGRESS REPORT

FISH RESEARCH PROJECT
OREGON

Draft Only

PROJECT TITLE: Native Trout Project
PROJECT NUMBER: F-136-R
JOB NUMBERS: 1 and 2
PROJECT PERIOD: 1 October 1987 to 30 September 1988

*- Type biodiversity to be preserved
(1) hereditary dif. Hatching time Apd. C
(2) Disease resist. Ceratomyxa
*(3) Sterile trout

Prepared by: A.R. Hemmingsen
D.V. Buchanan
D.L. Bottom
K.R. Currens
F.C. Shrier

CONTENTS

Job 2. A Stock Characterization of Oregon's Native Trout

Objectives for FY 1988

The following objectives were identified for FY 1988:

1) Determine the timing and magnitude of upstream movement of adult redband trout in the lower Blitzen River.

2) Determine the timing and magnitude of downstream movement of juvenile redband trout in the east diversion canal of the lower Blitzen River.

3) Determine the timing and magnitude of upstream fish migration at Link River, Keno, and John Boyle dams on the Klamath River.

4) Determine the origin and movement of native rainbow trout past Link River, Keno, and John Boyle dams on the Klamath River.

5) Collect samples of native rainbow trout in Harney and Upper Klamath basins for analysis of morphological and biochemical characteristics.

6) Generate homologous (within stock) and heterologous (between stock) populations of native rainbow trout for future determination of genetic or environmental control of life history differentiation.

7) Collect groups of native rainbow trout and expose them to infection by Ceratomyxa shasta to determine their relative resistance to ceratomyxosis.

8) Attempt to sterilize a group of hatchery rainbow trout by methods that utilize synthetic hormone treatment so that interbreeding between hatchery and native rainbow trout can be prevented.

Accomplishments in FY 1988

Progress on all eight objectives was accomplished. Objective 1 was not fully accomplished because sampling was performed only three months. Objectives 2 and 4 were not fully met since insufficient data were collected; reasons for that are presented in the following section.

Findings in FY 1988

Job 2, Objective 1: Determine the timing and magnitude of upstream movement of adult redband trout in the lower Blitzen River.

INTRODUCTION

This objective is specifically identified under Goal II, Objective 1, Task 1.1 of the Native Trout Project proposal (Buchanan et al. 1988). Activities described here reflect the first year of a four-year effort to determine life history characteristics of trout populations in Harney Basin. Traps that captured adult trout that moved upstream were installed at Sod House, Grain Camp and Page Springs dams on the lower Blitzen River within the Malheur National Wildlife Refuge. Those traps were monitored throughout April, May and June 1988. Rainbow trout 18 cm or larger that were captured in the traps were tagged to help describe movement of adult trout. Additional methods are described in Appendix A, a report submitted to the Malheur National Wildlife Refuge in return for support of activities.

RESULTS

Nine adult rainbow trout were captured at Page Springs Dam (Table 1, Appendix A) and 57 adult rainbow trout were captured at Grain Camp Dam (Table 2, Appendix A). No adult trout were captured at Sod House Dam, indicating that no such fish emigrated from Malheur Lake during April-June. Primary upstream movement of adult rainbow trout in the lower Blitzen River occurred during mid-April, early May and mid-June. A total of 57 rainbow trout were tagged during the study period, and of those 14% were recaptured by anglers. Additional results and discussion are detailed in Appendix A.

Job 2, Objective 2: Determine the timing and magnitude of downstream movement of juvenile redband trout in the east diversion canal of the lower Blitzen River.

INTRODUCTION

This objective also is specifically identified under Goal II, Objective 1, Task 1.1 of the Native Trout Project proposal (Buchanan et al. 1988). The work described here reflects the first year of a four-year effort to determine life history characteristics of trout populations in Harney Basin. An inlcined-screen trap was installed at a small diversion dam downstream from Page Springs Dam in the east diversion canal located in the Malheur National Wildlife Refuge (see Appendix A). The trap was operated a total of 340 hours during April, May and June 1988.

RESULTS AND DISCUSSION

Fifteen juvenile rainbow trout were captured during the entire period of operation (Table 4, Appendix A). While that result indicates that some downstream movement occurred, insufficient information was obtained to satisfy this objective. As discussed in Appendix A, fluctuations in stream flow frequently prevented effective operation of the trap. Recommendations to Malheur National Wildlife Refuge personnel included installation of structures adequate to enable thorough evaluation of downstream movement of juvenile trout.

Job 2, Objective 3: Determine the timing and magnitude of upstream fish migration at Link River, Keno, and John Boyle dams on the Klamath River.

INTRODUCTION

This objective is specifically identified under Goal II, Objective 1, Task 1.1 of the Native Trout Project proposal (Buchanan et al. 1988). Activities described here were conducted during the first year of a four-year effort to determine life history characteristics of trout populations in the Upper Klamath Basin. Traps that captured adult trout which moved upstream were installed at Link River, Keno, and John Boyle dams and operated as described in Appendix B.

RESULTS AND DISCUSSION

Job 2, Objective 4: Determine the origin and movement of native rainbow trout past Link River, Keno, and John Boyle dams on the Klamath River.

INTRODUCTION

This objective is specifically identified in the work plan described as Appendix A of the Native Trout Project proposal (Buchanan et al. 1988). That work plan was developed to help accomplish Objective 1 under Goal II of the Native Trout Project proposal (Buchanan et al. 1988). Activities described here reflect work from the first year of a four-year effort to determine life history characteristics of trout populations in the Upper Klamath Basin. Rainbow trout captured in traps at Link River, Keno, and John Boyle dams were tagged as described in Appendix B.

RESULTS AND DISCUSSION

Job 2, Objective 5: Collect samples of native rainbow trout in Harney and Upper Klamath basins for analysis of morphological and biochemical characteristics.

INTRODUCTION

This objective is identified in tasks specified in Objectives 2 and 3 under Goal II of the Native Trout Project proposal (Buchanan et al. 1988). Justification for this work has been presented (Buchanan et al. 1988) and is further described in Appendix C. During FY 1988, groups of rainbow trout to be studied were identified and collected. This work represents the first of a five-year effort to determine how genetic variation in native trout is distributed in Oregon.

RESULTS AND DISCUSSION

In Harney Basin, samples of rainbow trout were collected from Black Canyon, Cottonwood, and Dinner creeks and the Little Blitzen River. In Upper Klamath Basin, samples of rainbow trout were collected from Brownsworth, Buckboard, Coyote, Deming, Leonard, Long, Pothole, Spring, and Whitworth creeks (Appendix C). Biochemical and morphological analysis of those groups will be reported later.

Job 2, Objective 6: Generate homologous (within stock) and heterologous (between stock) populations of native rainbow trout for future determination of genetic or environmental control of life history differentiation.

INTRODUCTION

Completion of this objective is required for attainment of Objective 5 under Goal II of the Native Trout Project proposal (Buchanan et al. 1988). This work represents the first year of effort to determine whether genetically different life history patterns exist among populations of rainbow trout within and between basins in Oregon (Appendix C). During FY 1988, progeny that will be tested for genetic differences in behavior were produced by mating adult rainbow trout from Deming and Spring creeks in the Upper Klamath Basin as described in Appendix C.

RESULTS AND DISCUSSION

Significant differences in the mean and variance of hatching times occurred between progeny of rainbow trout from different environments in the Upper Klamath Basin (Appendix C). These results provide evidence of paternal difference in the genetic control of hatching time. Implications of these results are discussed in Appendix C.

Job 2, Objective 7: Collect groups of native rainbow trout and expose them to infection by Ceratomyxa shasta to determine their relative resistance to ceratomyxosis.

INTRODUCTION

Completion of this objective is required for attainment of Objective 4 under Goal II of the Native Trout Project proposal (Buchanan et al. 1988). Progress described here represents the first of a four-year effort to determine the relative resistance of native trout populations to certain pathogens.

Several salmonid species, including rainbow trout, are susceptible to infection by the myxosporean parasite Ceratomyxa shasta (Zinn et al. 1977). Infection by C. shasta may result in ceratomyxosis (Schafer 1968; Johnson 1975), a disease that can cause high mortality in certain salmonid populations (Ratliff 1981). Variable susceptibility to infection by the parasite has been demonstrated among stocks of certain species, such as chinook salmon Oncorhynchus tshawytscha (Zinn et al. 1977), coho salmon Oncorhynchus kisutch (Hemmingsen et al. 1986) and summer-returning steelhead Oncorhynchus mykiss (Buchanan et al. 1983; Wade 1987). In cases that involved salmonid stocks that were resistant to infection by C. shasta, resistance was demonstrated to be heritable (Hemmingsen et al. 1986; Wade 1987). Those results suggest that resistance to ceratomyxosis can be used to characterize native trout stocks and provide specific examples of the general use of disease resistance for that purpose (Ihssen et al. 1981). Since native rainbow trout and C. shasta are known to coexist in Upper Klamath Lake, we hypothesized that certain populations of rainbow trout in Upper Klamath Lake Basin are resistant to infection by C. shasta. In 1988, we initiated experiments to determine the relative resistance of native trout populations in Harney Basin and in the Upper Klamath Basin to infection by C. shasta.

METHODS

Exposure of fish to water that contains the infective stage of *C. shasta* is the only practical method of inducing ceratomyxosis (Johnson et al. 1979). Identification of a site where native trout could be exposed to *C. shasta* and infected by the parasite if they were susceptible to ceratomyxosis was our first objective. We obtained juvenile Cape Cod rainbow trout, known to be susceptible to ceratomyxosis (Zinn et al. 1977), from Klamath Hatchery. On 19 and 20 May 1988, samples of 120 of those fish were placed in 1.5-m^3 live-boxes, which were placed at six locations in the Upper Klamath Basin. Those locations included the Williamson River (RM 12) about one mile above the confluence with the Sprague River; the Williamson River (RM 2) about two miles above the confluence with Upper Klamath Lake; the east side of Agency Lake; Upper Klamath Lake at Modoc Point; Upper Klamath Lake at Pelican Marina; and the mainstem Klamath River (RM 225) near the fish ladder below John Boyle Dam. Similarly, on 24 May live-boxes were placed in the lower Blitzen River (Harney Basin) at Sod House Dam and in Malheur Lake near the mouth of Blitzen River (Appendix A). Trout in the live-boxes were monitored regularly; fish were fed Rangen's trout diet treated with oxytetracycline (TM-50) to control bacterial infection. Mortalities were collected and frozen for subsequent analysis. Water temperatures at all exposure sites varied diurnally, but exceeded the threshold at which *C. shasta* becomes infective (Udey et al. 1975). After 17 days of exposure in the lower Blitzen

River system or 24 days of exposure at sites in the Upper Klamath Basin, half the number of fish from each group, referred to as replicate 1, were transferred to Corvallis and reared on well water in separate aquaria. The remaining number of fish, referred to as replicate 2, were given additional exposure time then transferred to Corvallis on 21 June.

Rainbow trout at Corvallis were fed a diet similar to that given while they were in live-boxes. Fish were monitored daily; dead fish were removed and a wet mount of a smear prepared from intestinal scrapings (Johnson et al. 1979) was examined for the presence of C. shasta spores. Live fish were sacrificed after __ days of rearing at Corvallis and similarly examined.

RESULTS AND DISCUSSION

No mortality from ceratomyxosis occurred in Cape Cod rainbow trout exposed in the lower Blitzen River or near the mouth of the Blitzen River in Malheur Lake (Appendix A). The groups of fish held at both locations for extended exposure time (replicate 2) succombed to high water temperatures after 10 June.

Within the Upper Klamath Basin, Cape Cod rainbow trout exposed at both locations in the Williamson River and in Agency Lake suffered high mortality from ceratomyxosis (Table 00). These results extend the known range of C. shasta. Prior to this experiment, Upper Klamath Basin waters known to contain the infective stage of *C. shasta* were limited to the Klamath River and Upper Klamath Lake (Johnson et al. 1979).

Table OO. Incidence of mortality among juvenile Cape Cod rainbow trout exposed to *Ceratomyxa shasta* at various locations during summer 1988. N is the number of fish exposed.

Exposure site	Percent total mortality (N)		Percent mortality of N with spores of *C. shasta*	
	Rep 1	Rep 2	Rep 1	Rep 2
Harney Basin:				
Blitzen R.				
Malheur Lake				
Klamath Basin:				
Williamson R:				
RM 12		107	98	
RM 2		59	93	
Agency Lake		61	100	
Modoc Point		17	71	
Pelican Marina		100	14	
Klamath R. (RM 225)		82	3	

Based on those results, the RM 2 site on the Williamson River was chosen as the site to expose groups of native trout. In September, 1988 we electroshocked samples of juvenile native rainbow trout from various locations in the Upper Klamath Basin. Those samples were placed in live-boxes located at RM 2 on the Williamson River for exposure to the infective stage of *C. shasta*. A group of Cape Cod rainbow trout from Klamath Hatchery was also exposed there as a control. Similar groups of Cape Cod rainbow trout were also placed in live-boxes located in most streams from which native trout samples were collected, thereby providing verification of results with native trout. Numbers of fish exposed and streams from which they originated are summarized in Table OO.

Table OO. Source of juvenile rainbow trout exposed to *Ceratomyxa shasta* in Fall 1988 and sites in the Upper Klamath Basin where they were exposed.

Sites where Klamath Hatchery rainbow trout were exposed to *C. shasta*.		Source of native rainbow trout exposed to *C. shasta* in the Williamson River at RM 2.
Water body	River mile	
Campbell Reservoir	-	Deming Creek
Williamson River	?, ?, 2	Spring Creek
Klamath Lake:		Spencer Creek
Modoc Point	-	Klamath River (RM 224)
Wood River	?	Johnson Creek
Fort Creek	1	Cold Creek
Klamath River	230, 225	Jenny Creek
Spencer Creek	1	
Jenny Creek	19	

Trout in the live-boxes were maintained as previously described. Again, water temperatures at all exposure sites varied diurnally, but exceeded the threshold at which *C. shasta* becomes infective. Groups of fish were transferred to Corvallis for further rearing on 30 September or later. Results of that work will be presented in a subsequent report.

Job 2, Objective 8: Attempt to sterilize a group of hatchery rainbow trout by methods that utilize synthetic hormone treatment so that interbreeding between hatchery and native rainbow trout can be prevented.

INTRODUCTION

Justification for sterilization of hatchery trout where they are used to supplement waters that contain native trout has been presented (Buchanan et al. 1988). Sterility in salmonids can be induced by several techniques, including chromosome manipulation, application of hormones, or some combination of both (Donaldson 1986). Criteria that we considered important in the selection of a technique included 1) produce sterility in all individuals in a population (ie. 100% sterility); 2) do so with relative ease at low cost; and 3) eliminate false spawning in adult fish. False spawning is defined as the attempted mating by one sterile and one fertile fish; the outcome would be no progeny from the fertile individual. Based on literature review, it appeared that treatment with the synthetic hormone 17 @-methyltestosterone by the methods described by Solar and Donaldson (1985) offered the best chance of meeting our criteria. Work reported here represents the first year of efforts to accomplish Objective 2 under Goal III of the Native Trout Project proposal (Buchanan et al. 1988).

METHODS

During January 1988, treatment with 17 @-methyltestosterone (MT) was initiated to rainbow trout at Roaring River Hatchery. At 3 and 10 days after hatching, about 10,000 alevins were immersed for 2 hours in 35 liters of solution that contained 400 ug MT per liter of water. Alevins were contained in an incubator (Heath-Tecna, Inc.) tray that was submerged in the solution. Bottled oxygen was provided the entire time for aeration and circulation. After each immersion, the tray was returned to the incubator stack.

Following absoption of the yolk-sac, fish were placed in a -liter circular rearing tank. A similar number of untreated fish (controls) were placed in an identical tank. After the fish had recieved a starter diet for about 1 week (early March), the MT-treated trout were placed on a diet that contained 25 mg MT per kg feed. That diet was administered ad libitum daily for 90 days. Controls were treated similarly except that their diet lacked MT.

RESULTS AND DISCUSSION

MT-treated and untreated rainbow trout were identified with differential fin clips. During June 1988, at an average size of 2.5 g, fish were stocked in several Cascade lakes (Table 00).

Those fish will be monitored for growth and longevity. Final evaluation will be based on the percentage of sterile individuals at the normal time of maturity. Samples of MT-treated trout will remain at Roaring River Hatchery for such evaluation.

Table 00. Juvenile rainbow trout stocked in certain Cascade lakes in 1988 after treatment with 17 @-methyltestosterone (treated) or lack thereof (control).

	Number of Trout	
Lake	Treated	Control
Big	1,000	1,000
Blair	3,500	0
Bradley	300	300
Bug	200	200
Fay	800	800
Lizard	200	200
Rae	150	150
Warner	265	265

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Appendix A

Occurrence and Migration of Redband Trout within the Malheur National Wildlife Refuge 1 April through 30 June 1988

~~Draft~~ Final Report

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INTRODUCTION

In response to strategies developed to meet certain objectives identified in the Oregon Trout Plan (1987), the Oregon Department of Fish and Wildlife (ODFW) with cooperation from Oregon State University (OSU) initiated research designed to characterize Oregon's native trout populations. One objective of the Native Trout Project is to determine life history traits which may contribute to the characterization of trout populations.

The Harney Basin was among those chosen to focus early research efforts since it contains numerous streams that support populations of redband trout (Oncorhynchus mykiss). One of those streams, the Blitzen River, heads on the west side of Steens Mountain in southern Harney County and flows north through the Blitzen Valley into Malheur Lake.

In the late 1800's and early 1900's, drainage and reclamation of the Blitzen Valley for ranching purposes reduced the water supply to Malheur Lake. Consequently, sanctuary for migratory waterfowl and habitat for nesting birds were threatened. In 1935, the Blitzen Valley and the P Ranch, once headquarters of the Peter French cattle empire, were added to the Malheur National Wildlife Refuge.

Malheur Refuge contains about 64 linear km of the lower Blitzen River. Page Springs Dam, near the community of Frenchglen, diverts much of the mainstem Blitzen River into two primary canals (east and west). On the mainstem Blitzen River, in series downstream from Page Springs Dam, lie Buckeroo, Grain Camp, Busse, Dunn, Sod House, and now submerged Springer dams. Originally constructed to divert Blitzen River water for ranching purposes, these dams were rebuilt in the 1920 to 1940 era with provisions to allow upstream passage of adult fish. In addition to these dams, numerous side-channel structures continue to divert Blitzen River water for the enhancement of avian habitat.

The Blitzen drainage basin contains 446 linear km of water suitable for trout production. Historically, redband trout were abundant in both the Blitzen River system and in Malheur Lake (Hosford and Pribyl 1983), which implies migration between a rich rearing area and the primary spawning areas upstream from Malheur Refuge. In 1988, Malheur National Wildlife Refuge provided cooperative support for a 3-month assesment of the migration of redband trout in the lower Blitzen River. Two objectives were identified to determine both upstream and downstream movement of adults and juveniles, respectively.

Objective 1. Determine the timing and magnitude of upstream movement of adult redband trout in the lower Blitzen River.

Objective 2. Determine the timing and magnitude of downstream movement of juvenile redband trout in the east diversion canal of the lower Blitzen River.

Common carp Cyprinus carpio were introduced into Malheur Lake in the late 1930's (Hosford and Pribyl 1983), and the population has subsequently expanded in numbers. Although carp inhabit the lower Blitzen River within Refuge confines, concerns were expressed that passage facilities at Sod House Dam might permit the movement of additional carp from Malheur Lake. Furthermore, a private party had expressed plans to explore the feasibility of harvesting carp below Sod House Dam for commercial purposes. ODFW was concerned that redband trout might be incidentally harvested along with the carp. Therefore, two additional objectives were identified:

<u>Objective 3</u>. Determine the ability of a facility at Sod House Dam to allow the upstream passage of redband trout and other native fishes while preventing the passage of carp.

<u>Objective 4</u>. Determine the occurrence of redband trout in the exploratory harvest of carp below Sod House Dam.

This report summarizes activities and results of the cooperative study conducted in 1988.

METHODS

During the first week of April, stoplogs were added to existing concrete structures at Sod House, Busse, and Dunn dams. The resultant ladders permitted upstream passage of native fish. Traps to capture adult trout moving upstream were installed in one step of each ladder at Sod House, Grain Camp, and Page Springs dams. Each trap consisted of a V-shaped fyke at the downstream end which permitted entry; passage of adult fish over the next upstream set of stoplogs was blocked by a weir. Stream flow was adjusted as needed to allow fish passage.

Traps were monitored for the presence of adult fish at least four times each week throughout the study period. During periods of extreme diurnal fluctuation in stream flow or when it appeared that many fish would be caught, traps were monitored twice daily. No more than a single day elapsed between visitations to a particular trap. Captured trout were netted and anesthetized with tricaine methansulfonate (MS-222). Fork length and scale samples were collected and sex classification (if possible) and general condition were noted for each fish. All fish 18 cm or larger were identified with numbered Floy anchor tags inserted just below the anterior portion of the dorsal fin. Fish were allowed to recover in a container of fresh water then returned to the river above the ladder. Carp that were captured in an adult trap were counted and returned to the river below the ladder.

Anglers were informed of the possibility of catching a tagged fish by signs located at Malheur Refuge headquarters and field station, Frenchglen hotel and store, Camper Corral, and B & B Sporting Goods in Burns. Collection boxes with each sign permitted voluntary return of tags from angler-caught fish.

Juvenile redband trout that moved downstream were captured by a trap installed in a small diversion dam in the East Canal about 0.4 km downstream from Page Springs Dam. The trap consisted of an inclined screen which diverted most of the stream flow and directed fish into a 15-cm flexible tube. Fish then passed into a screened box located in a nearby pool where they held until they were sampled. The trap was designed to sample about half the flow through the East Canal during low water conditions expected during the study.

At the end of the study, all traps were removed. Additional stoplogs were added to the head of the ladder at Sod House Dam, which eliminated the flow of water through the ladder and blocked upstream passage of trout or carp.

RESULTS

Objective 1:

Few adult redband trout were captured and tagged at Page Springs Dam, and most of those trout were captured the third week of April (Table 1). Of the nine fish captured, there were three females, three males, and three whose sex could not be determined. All but one appeared to be in good physical condition.

Table 1. Adult redband trout captured in the upstream trap at Page Springs Dam during April, May, and June 1988.

Date	Number of fish trapped	Fork length (cm) range	Fork length (cm) mean	Number of fish tagged	Hr trap operated
04/07-10	0				96
04/11-17	1	41.5	41.5	1	120
04/18-24	6	38.0 - 54.0	44.1	6	168
04/25-05/01	0				156
05/02-08	0				168
05/09-15	0				168
05/16-22	1				168
05/23-29	1	30.7	30.7	1	168
05/30-06/05	0	48.6	48.6	1	168
06/06-12	0				168
06/13-19	0				168
06/20-30	0				168
					264
Total	9			9	

The majority (86%) of captured redband trout were trapped at Grain Camp Dam (Table 2). The second week of both April and May appeared to be the periods of primary fish movement. As was the case at Page Springs, no redband trout were captured the last week of April or the first week of May. The total number of fish captured (57) includes one fish recaptured once and another recaptured twice. Both those fish were originally trapped at Grain Camp.

No sex data are available for the 12 trout captured during the second week of April (Table 2). Of the remaining 45 trout, there were 21 females, 20 males, and four whose sex could not be determined. Five mortalities were associated with the trapping activities at Grain Camp Dam. Four dead fish were found in the trap, all wedged between grates of the trap. A fifth fish (#138) tagged on 24 June was found dead in the top of the ladder on 27 June. All other captured trout were in good physical condition.

The difference between the total number trapped and the total number tagged (9) includes three recaptured fish, four mortalities, one fish that escaped, and one fish that was too small to tag. No adult redband trout were captured at Sod House Dam.

Table 2. Adult redband trout captured in the upstream trap at Grain Camp Dam during April, May, and June 1988.

Date	Number of fish trapped	Fork length (cm)[a] range	Fork length (cm)[a] mean	Number of fish tagged	Hr trap operated
04/07-10	0				96
04/11-17	12[b]	23.5 - 31.0	27.8	10	156
04/18-24	3[c]	25.0 - 33.2	29.4	2	168
04/25-05/01	1	17.0	17.0	0	168
05/02-08	0				168
05/09-15	16	23.2 - 36.8	29.4	16	168
05/16-22	2[c]	26.0	26.0[d]	1	168
05/23-29	5[e]	23.2 - 38.4	28.5	3	168
05/30-06/05	0				168
06/06-12	0				168
06/13-19	12[f]	21.7 - 38.0	30.1	11	168
06/20-30	6[g]	23.2 - 30.7	27.5	5	264
Total	57			48	

a/ Unless otherwise noted, length values pertain to all fish, including recaptures, that entered the trap on a given day.
b/ Includes one dead fish and one fish that escaped untagged.
c/ Includes one dead fish.
d/ No length taken on the one dead fish.
e/ Includes one dead fish and one recaptured fish (#103) tagged at Grain Camp on 05/10/88.
f/ Includes one recaptured fish (#113) tagged at Grain Camp on 05/13/88.
g/ Includes tagged fish #103 recaptured a second time.

Fifty-seven redband trout were tagged during the study period. Of that total, three were recaptured at Grain Camp Dam, one was recovered dead, and eight were caught by anglers. Seven of the eight angler-caught trout were tagged at Grain Camp Dam and caught between there and Page Springs Dam. One trout tagged at Page Springs Dam was caught upstream below the Gauging Station Dam (Table 3).

Table 3. Summary of redband trout tagged and recaptured in Spring, 1988.

Fish ID	Length (cm)	Initial capture Date	Initial capture Location	Recapture Date	Recapture Location	Method
3639	27.0	04/12	Grain Camp	05/31	Between Page Spr. and P Ranch	angling
103	23.2	05/10	Grain Camp	05/24	Grain Camp	trap
103	"	"	"	06/20	"	"
104	29.5	05/11	Grain Camp	06/10	200 m below Page Springs	angling
105	29.7	05/11	Grain Camp	05/22	About 1.2 km below Frenchglen	angling
113	31.4	05/13	Grain Camp	06/14	Grain Camp	trap
115	33.7	05/13	Grain Camp	05/31	Between Page Spr. and P Ranch	angling
118	27.2	05/13	Grain Camp	06/02	Between P Ranch and Camper Corral	angling
121	29.0	05/24	Grain Camp	06/08	Between P Ranch and Camper Corral	angling
129	33.8	06/17	Grain Camp	06/27	Between Page Spr. and P Ranch	angling
138	30.7	06/24	Grain Camp	06/27	Top step of Grain Camp ladder	mortality
202	38.5	04/19	Page Spr.	05/09	Below gauging dam about 3 km above Page Spr.	angling

Objective 2:

Few juvenile redband trout were captured in the downstream trap in the East Canal (Table 4). Fork length of the captured trout ranged from 9 to 15 cm.

Table 4. Juvenile redband trout captured in the downstream trap in the East Canal during April, May, and June 1988.

Date	Number fish trapped	Mean fork length (cm)	Hr trap operated[a]
04/07-10	0		36
04/11-17	13	10.3	32
04/18-24	1	11.5	46
04/25-05/01	0		32
05/02-08	0		30
05/09-15	0		22
05/16-22	1	15.0	42
05/23-29	-		0
05/30-06/05	-		0
06/06-12	0		71
06/13-19	0		29
Total	15		

a/ Estimated number of hours; much of this time the trap was ineffectively operating due to fluctuations in water flow.

Objective 3:

One hundred eighty-seven common carp were captured during May and June in the upstream trap at Sod House Dam (Table 5). Most of the carp entered the trap during periods of low water flow through the trap.

Table 5. Summary of common carp captured in the upstream trap at Sod House Dam during April, May, and June 1988.

Date	Number of fish trapped	Hr trap operated
04/07-10	0	84
04/11-17	0	156
04/18-24	0	24
04/25-05/01	0	168
05/02-08	0	158
05/09-15	1	168
05/16-22	3	158
05/23-29	12	168
05/30-06/05	0	168
06/06-12	0	168
06/13-19	129	168
06/20-30	42	264
Total	187	

Objective 4:

The exploratory harvest of carp by a private party did not occur as proposed. However, on 23 June, that party did harvest about 1,000 lb of carp below Sod House Dam. There is no record to indicate any redband trout were also harvested incidentally.

Miscellaneous activities:

Populations of native trout may exhibit differential resistance to various fish pathogens, and determination of that differential resistance is another means by which characterization of trout stocks can be attained. One objective identified in the Native Trout Project is to determine the relative resistance of trout populations in Harney Basin to certain pathogens. In 1988, we initiated studies to determine the possible existence and distribution of *Ceratomyxa shasta*, a myxosporean parasite that can cause high mortality in non-resistant stocks of salmonid fish (Zinn et al. 1977).

Juvenile rainbow trout known to be susceptible to infection by *C. shasta* were were placed in live cages on 24 May and held for exposure at Sod House Dam and in Malheur Lake near the mouth of the Blitzen River. On 10 June, after sufficient time for probable infection by the parasite, half the number of each group of exposed fish were transferred to Corvallis for further rearing.. The remaining half of each group remained in live cages for additional exposure time.

High water temperatures after 10 June caused the loss of fish from both groups held for extended exposure. Fish reared at Corvallis were monitored daily. Dead fish were removed and examined for the presence of *C. shasta* spores by the methods of Johnson et al. (1979). On 15 August, all fish that remained were sacrificed and similarly examined. No fish from either exposure site showed symptoms of infection by *C. shasta*. These results suggest that *C. shasta* is not present in the lower Blitzen River and Malheur Lake, although further experiments are needed for confirmation.

DISCUSSION AND RECOMMENDATIONS

We expected to capture and tag a larger number of redband trout than we did. During a similar time period in Spring 1987, 127 redband trout were captured in upstream traps located at Grain Camp and Page Springs dams (Bill Hosford, personal communication). The captures reported in this study (57) amount to 45% of the total reported for 1987. Aquatic debris and fluctuations in stream flow frequently appeared to diminish the efficiency of the traps to capture adult trout. However, the traps were routinely restored to acceptable operating conditions and as such they should have captured any trout whose movement had been impeded. We have no explanation for the lack of adult trout captured at Sod House Dam. The trap did capture carp; therefore one might expect that if adult redband trout were present below the dam and if they desired to move upstream, they should have appeared in the trap. We recommend that upstream traps at Sod House, Grain Camp and Page Springs dams be operated again in 1989 to verify past results.

The trap at Page Springs Dam accounted for only 9 (16%) of the adult redband trout captured. We suspect that passage problems may exist in the ladder at low flows. Although the trap at Grain Camp captured the majority of adult trout, all mortalities observed during the study period occurred there. Four of the five dead fish were found wedged between grates of the trap. Those fish may have been wedged during high flows through the trap. On the other hand, the results may indicate that construction of the trap permit [illegible] unaccounted passage of small fish.

With allowance for one tagged fish found dead at Grain Camp, 14% of the redband trout tagged in 1988 were recaptured by anglers. That result agrees favorably with 1987 figures where 16 of 119 tagged redband trout (13%) were recaptured by anglers.

It appeared that the capture of carp in the trap at Sod House Dam was associated with low water flow. If so, the facilities may allow passage of trout but prohibit passage of carp at high flow. Further modification and experimentation remains to be done if carp passage is to be prohibited under all stream conditions. It may be necessary to capture and tag adult trout upstream and release them below Sod House Dam to adequately test future designs.

During April and the first half of May, water flow in the East Canal fluctuated greatly both within a 24-hr period and between days due to snow melt and rainfall in the upper Blitzen River Basin. The juvenile trap was unable to effectively capture fish under those conditions. At low flows, the trap was dry since no water covered the inclined screen. At high flows, water would flood the screen or separate the flexible hose from the holding box. As a result, we can conclude little regarding downstream movement of juvenile redband trout in the lower Blitzen River. Istallation of more rugged structures that will sample all the water diverted into the east and west canals is in progress. We recommend that those structures be utliized to monitor downstream movement of juvenile fish in 1989. We also suggest a meeting with Malhuer National Wildlife Refuge staff to discuss plans for studies in 1989.

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We greatly appreciate the cooperation and assistance provided by Malheur National Wildlife Refuge personnel.

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[1989]

Appendix B

Annual Report of Fish Trapping Activities in the Klamath Basin, Oregon in 1988

Prepared by

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January 1989

Introduction

In an effort to improve Klamath hydroelectric project operations it became apparent to both Pacific Power and Light (PP&L) and Oregon Department of Fish and Wildlife (ODFW) biologists that information was lacking on rainbow trout (Oncorhynchus mykiss formerly known as Salmo gairdneri) migration patterns around PP&L's Klamath projects. A Native Trout Project was proposed by ODFW to answer some of the questions regarding Klamath rainbows. Pacific joined forces with ODFW with the belief that the Native Trout Project was the most efficient means of accomplishing the task of identifying trout useage around the Klamath projects.

The introduction and problem approach for the Klamath River Native Trout Project proposal outlines five objectives for achieving and maintaining optimum populations and production of trout in Oregon (Buchanon and Hemmingsen 1987). From these five objectives, ODFW researchers identified three goals to address the principal management needs that are stated or implied. Goal number one, which is funded by the PP&L, calls for evaluating the present status and effectiveness of trout management programs and activities. An important component of the first goal is the trapping and marking of migrating trout and is the subject of this report.

Methods

Fyke traps constructed of extruded steel were placed in the fish ladders of J. C. Boyle, Keno and Link dams on the mainstem Klamath and Link Rivers. The traps were located near the middle or upper segments of the fish ladder facilities and were maintained by PP&L and operated by ODFW personnel. Trapping began in February and continued through December 1988. The traps were operated on a twenty-four hour basis, Monday through Friday, for the peak run times and three days a week at other times. Upon checking the traps, water temperature and pH were collected. Rainbow trout were captured, anesthetised, and tagged with a numbered Floy anchor tag. Fork lengths (mm) were taken and general condition of the fish was observed and recorded.

In addition to trapping, incidental fish salvage operations associated with the hydro projects provided further information on fish stock status and allowed for additional tagged individuals. On several occasions, electrofishing was employed to check for presence of fish in the approach pools below the ladders. Tags were placed in these fish as well and biological information was recorded.

A Pearson product-moment correlation procedure (SAS 1985) was performed on the temperature, pH and fish capture data to determine if a correlation exists between timing of fish migration and physical conditions in the rivers. Comparisons were also made between the current data and previous studies made on the Klamath by Beak Consultants (1986) and Hanel and Gerlach (1964).

Results

Link River Dam

The trap at Link River dam was fished for a total of 3,970.5 hours from February through December. During that period three trout and six non-game fish were captured resulting in 0.0008 trout/hour and 0.003 total fish/hour for 1988. The three trout captured averaged 607 mm and were trapped during the warmest period of the temperature cycle in June (Figure 1). Two of these trout were tagged and returned to the river above the Link River Dam. River temperatures ranged from 39° to 78° F while pH (Figure 2) ranged from 7.6 to 8.8 with the highest reading occurring during the peak temperature and primary productivity period in August.

Electrofishing checks below the ladder and in the river channel below the dam produced only a few non-game fish and no trout. However, two salvage operations in the Eastside canal and penstock overflow during the spring and summer produced 35 rainbow trout all of which were tagged and returned to either the river below or the lake above the dam.

Keno Dam

Fish passage at the Keno trap varied throughout the year and peaked during the fall migration period after temperature dropped below 65° F (Figure 3). The trap was fished for a total of 3,718.5 hours for the same time period as Link although rate of capture was considerably higher. A total of 2,216 fish were captured including 95 rainbow trout, 3 Lost River suckers (*Deltistes luxatus*) and 1 largemouth bass (*Micropterus salmoides*). Rainbows captured averaged 235 mm in length and 84 of those captured were tagged and returned to the river above the dam. The remaining numbers of fish captured consisted mostly of tui chubs (*Gila bicolor*) and fathead minnows (*Pimephales promelas*). The capture rate for rainbow and total fish at Keno trap was 0.03/hour and 0.6/hour, respectively with no recaptures reported. Temperature ranged from 38° to 77° F (Figure 3) and pH fell within the same range as Link River (Figure 2) however, peak pH occurred earlier in the summer.

J.C. Boyle Dam

Trap efficiency at Boyle ladder was not as high as Keno but the number of rainbow captured was greatest for all the traps. The Boyle trap was fished for 4,044 hours resulting in capture of 374 fish including 256 rainbows (206 tags) and 118 non-game fishes. This represents capture rates of 0.06

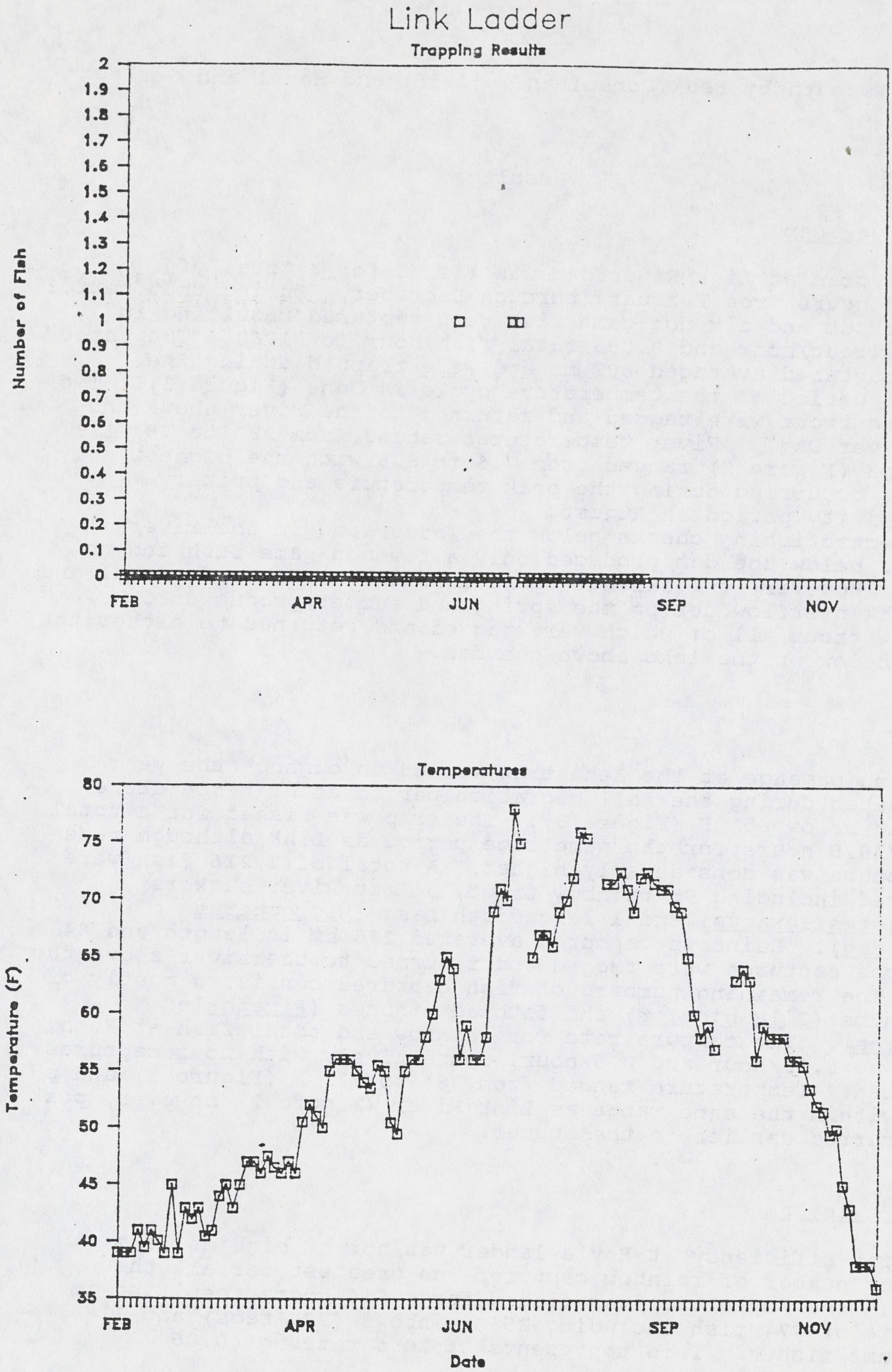
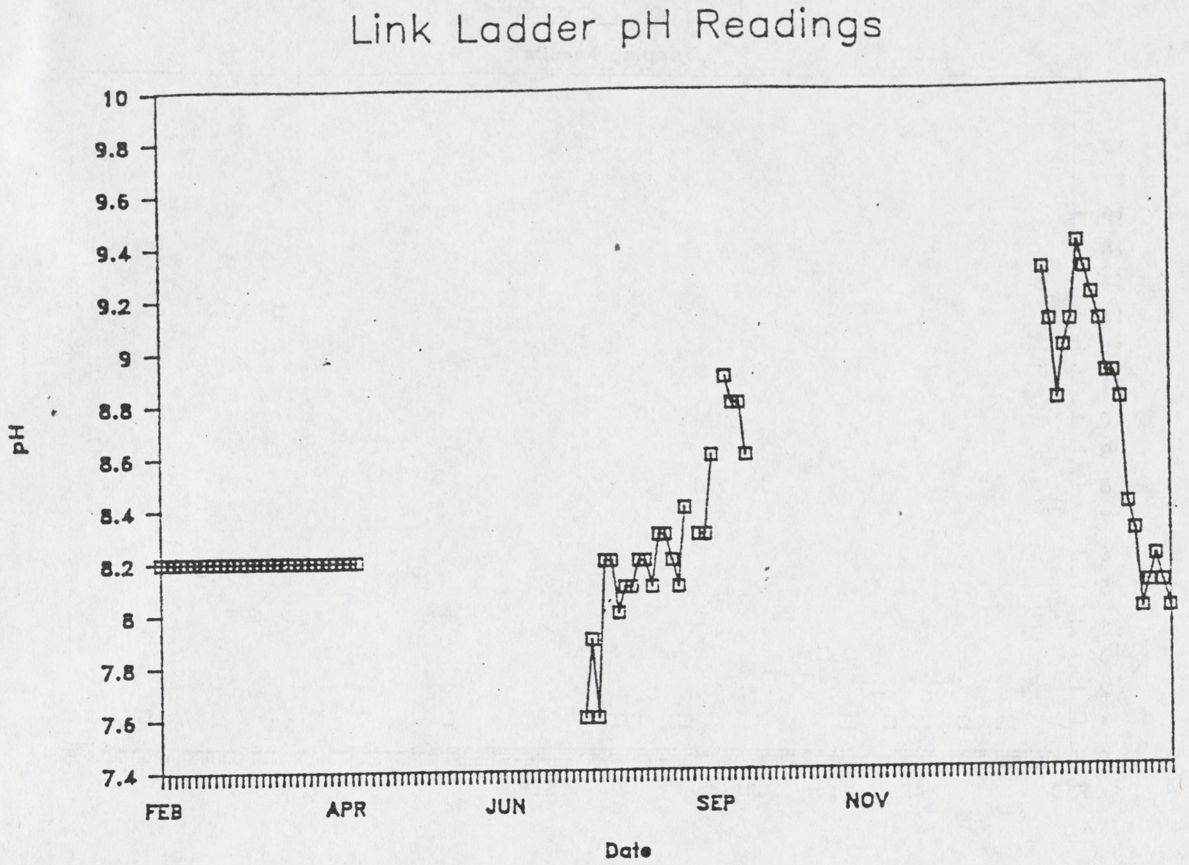


Figure 1. Temperature and fish capture data for the Link River ladder during 1988.



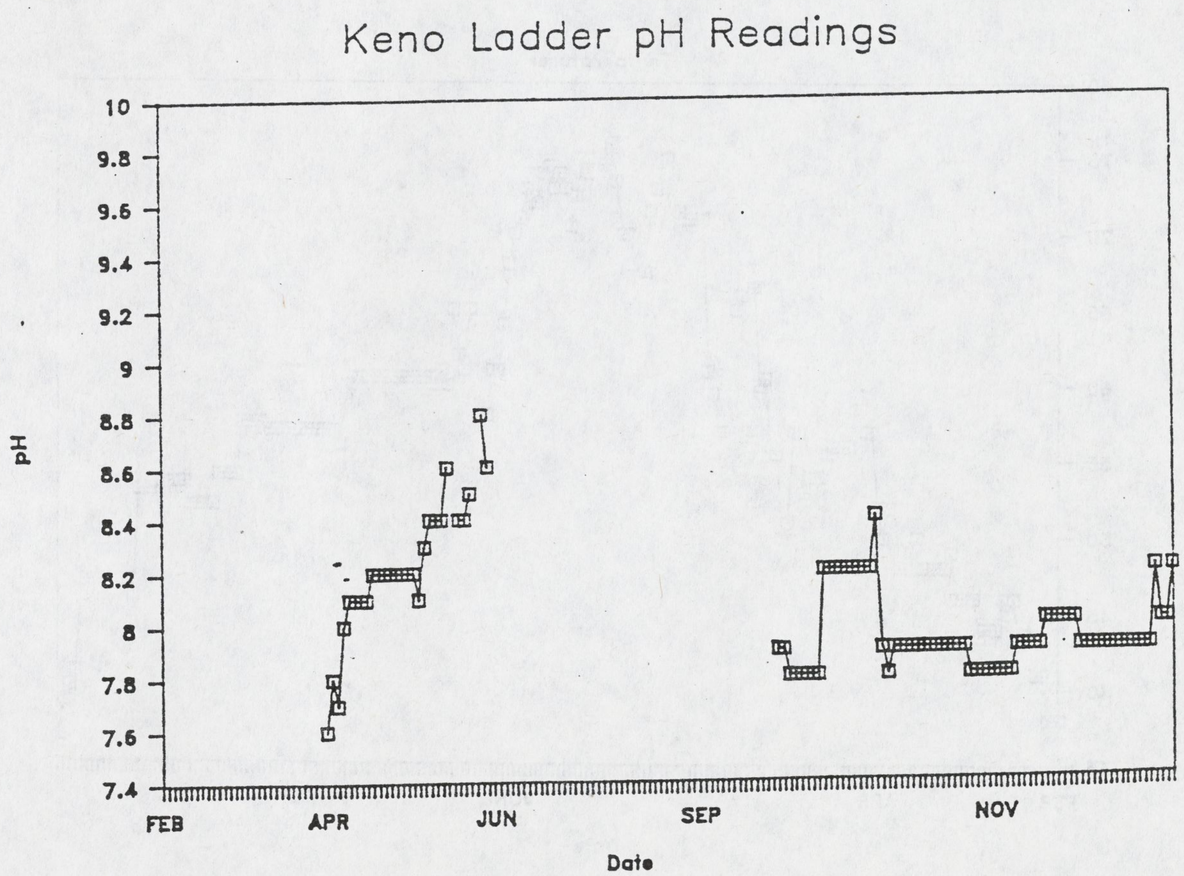


Figure 2. pH record for Link and Keno ladders during 1988.

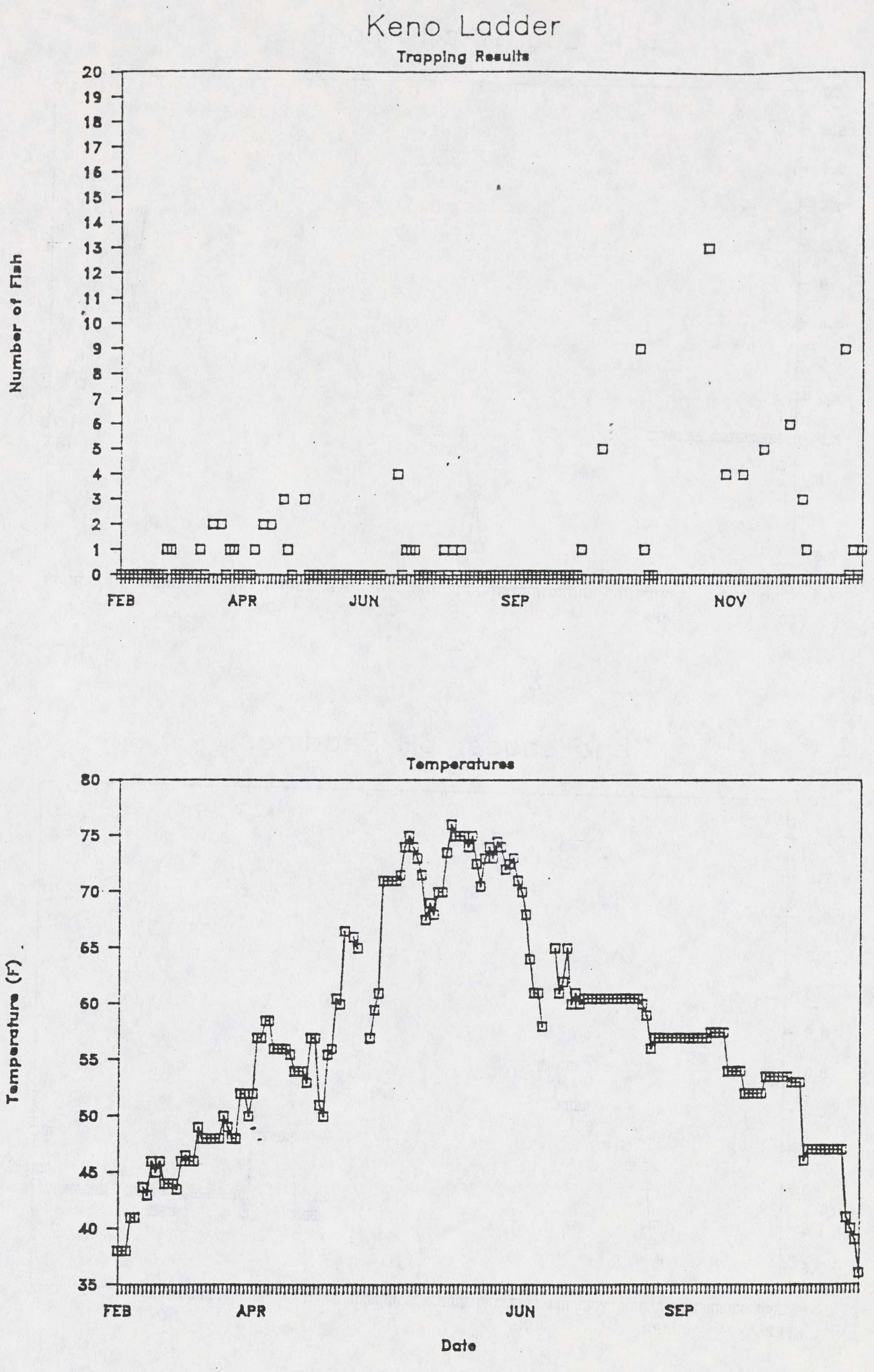


Figure 3. Temperature and fish capture data for the Keno ladder during 1988.

trout/hour and 0.09 total fish/hour. Average length of rainbows captured in the Boyle trap was 185 mm. As with the Keno migration, trout upstream migration peaked in October after summer temperatures began to drop (Figure 4). One trout was recaptured on November 11th in the Keno reach by an angler. The trout was tagged at the Boyle ladder on October 11, 1988. Beak also reported recapture of four trout which had been marked by their personnel in the Boyle reach during a concurrent study for the Salt Caves Hydroelectric Project (Beak, personnal communication). Temperatures at Boyle ranged from 37° to 78° F peaking in June (Figure 4) and pH ranged 7.6 to 8.7 also peaking in June (Figure 5).

A number of other trout were captured in the Boyle ladder, below the ladder and in the Boyle canal during 1988 using electrofishing gear. During those operations, 99 trout (67 tags) were collected and released into the river below the ladder.

General

For comparative purposes, data from Beak consultants (ibid.) (March to May, 1982) and Hanel and Gerlach (ibid.) (February to December period, 1959-62) were examined. Raw data from Beak showed peak migration at Boyle in the April to May period although no data was collected in the fall. Temperatures during that period ranged from 37.4° to 62.6° F and trout averaged 208 mm in length. Hanel and Gerlach reported peak migration occurring in March to April and temperatures for the trapping period (Feb. - Dec.) ranging from 36° to 78° F. Lengths for fish captured by Hanel and Gerlach were not reported.

Statistical analysis of the 1988 trapping data indicated a weak positive correlation between temperature and fish migration (Pearson coeff. = 0.089, $p > 0.03$). Fish migration and pH were negatively correlated (coeff. = -0.40176, $p > 0.0001$) indicating that as pH increased fish migration decreased. However, since pH and temperature are correlated (coeff. = 0.154, $p > 0.01$) one would expect the fish/pH interaction to be an artifact of temperature. A similar analysis of data from Hanel and Gerlach indicated no correlation between temperature and fish migration (coeff. = -0.0644, $p > 0.5465$). pH data was not taken during their study.

Discussion

In their report, Hanel and Gerlach speculated that fish migration at Boyle was governed by temperatures in the 40° to 68° F range with no movement occurring in water above 68° or below 40° F. This is intuitively apparent when graphed (Figure 6) however, no statistical correlation exists between temperature and migration suggesting that other factors influenced Klamath rainbow trout movement. A correlation does exist between migration and temperature for the 1988 data indicating that as temperature increases, migration increases. This relationship is relatively weak however and should not be taken literally. In

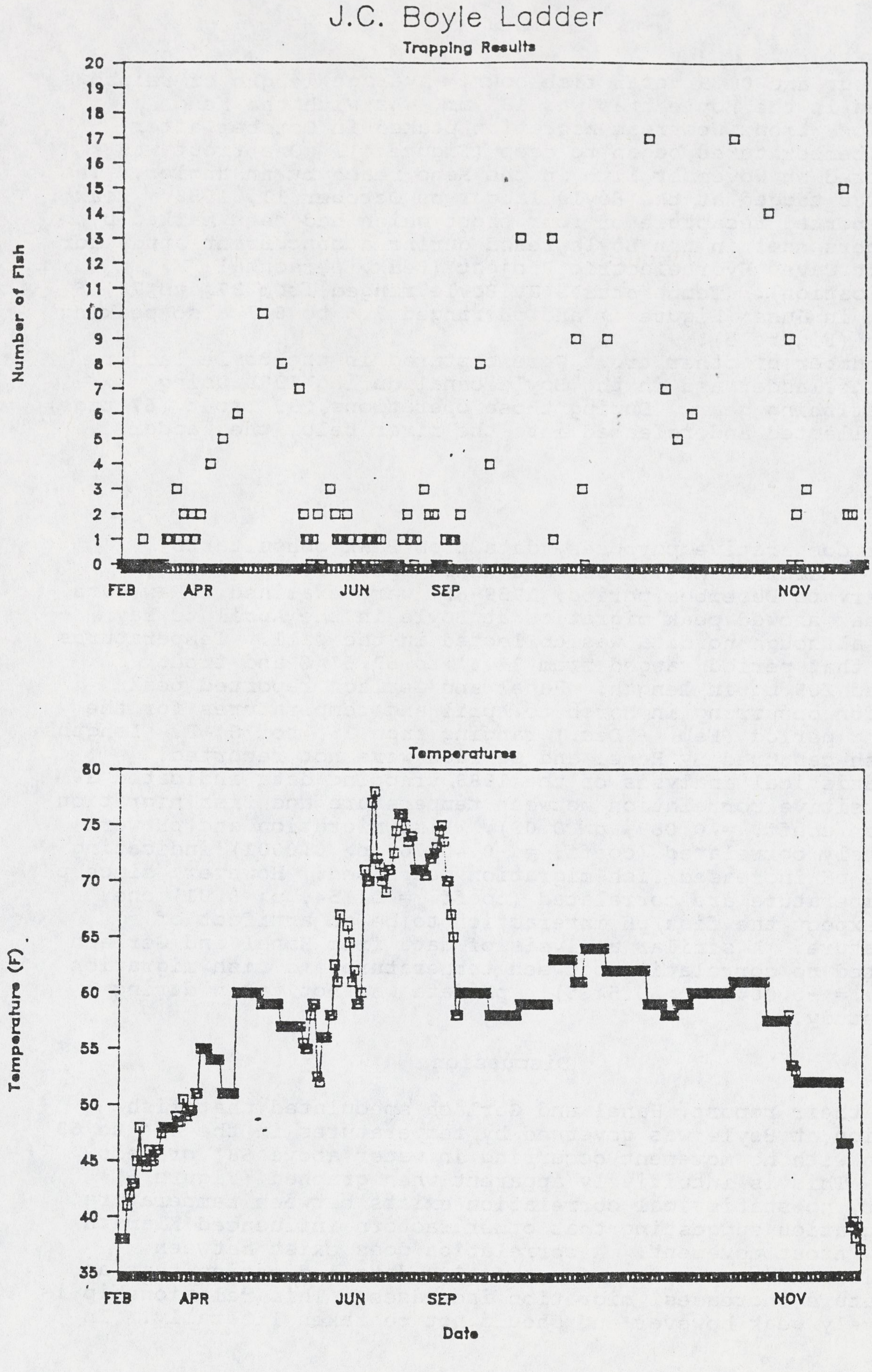


Figure 4. Temperature and fish capture data for the Boyle ladder during 1988.

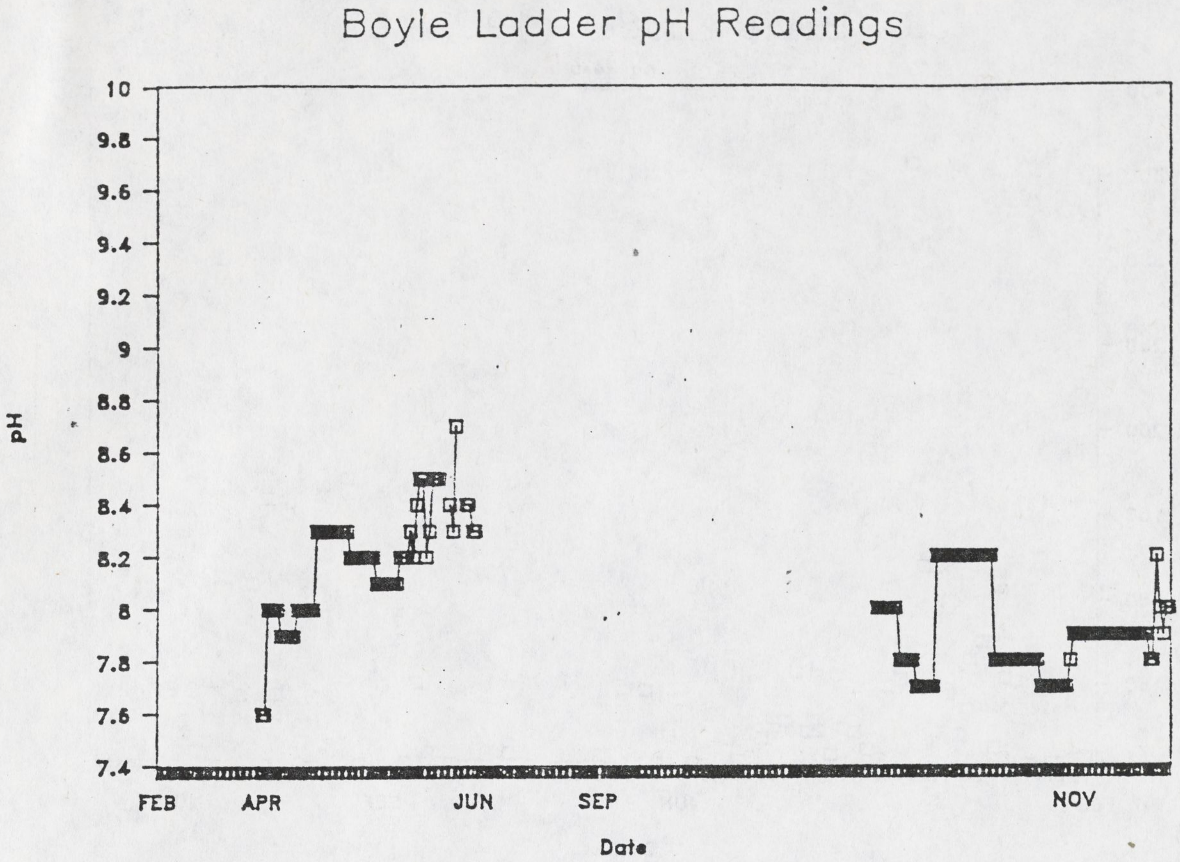


Figure 5. pH record for the Boyle ladder during 1988.

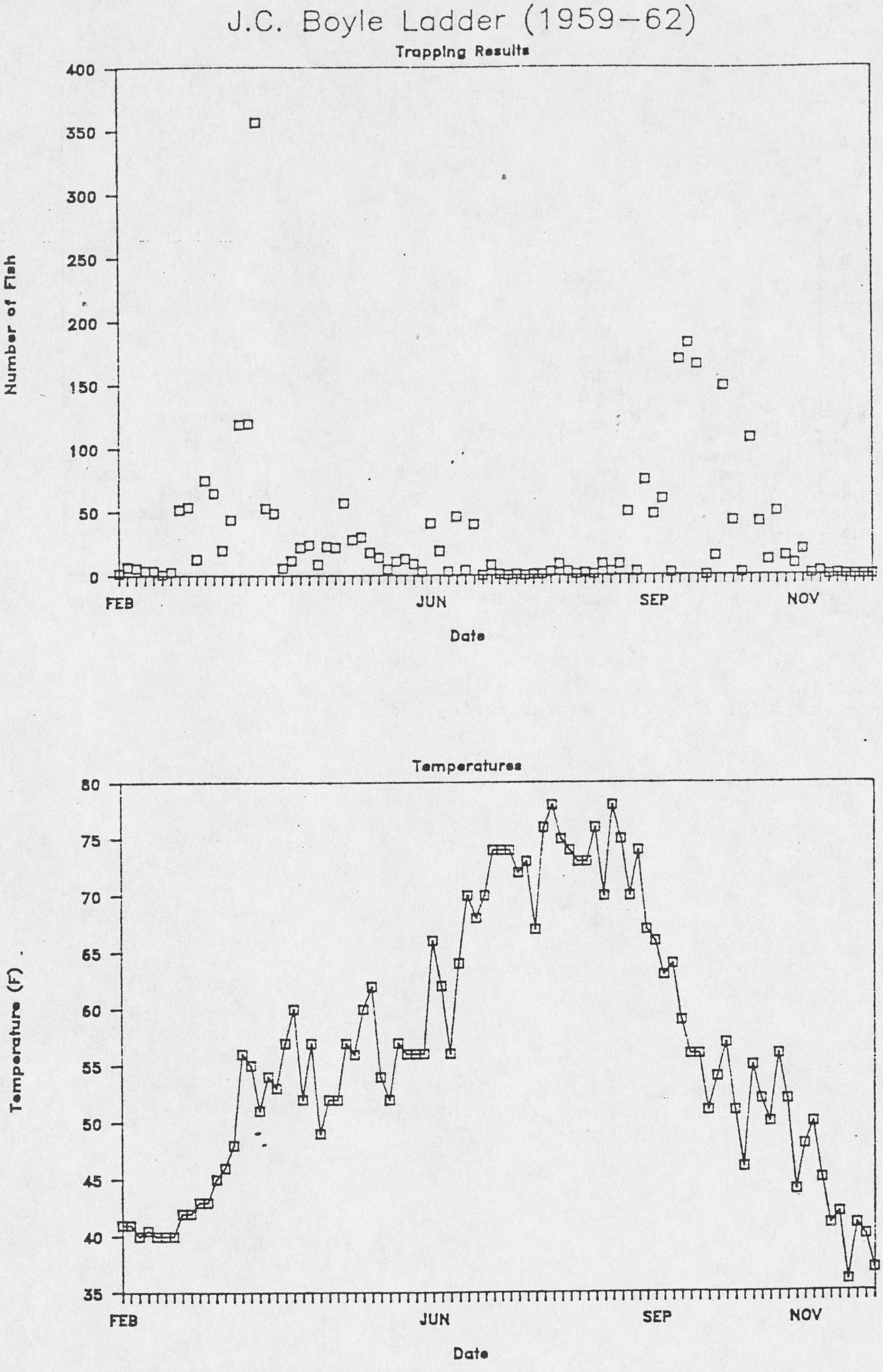


Figure 6. Upstream migrant rainbow trout trapping data for the Boyle ladder in 1959-62 (Hanel and Gerlach 1964).

fact, the opposite relationship appears to exist according to the graphs. As with data collected by Hanel and Gerlach, other factors not considered here probably influence timing and intensity of fish migration.

Trout captured at Boyle in the Beak studies were, on the average, larger than those of the 1988 study. The meaning of this point is not intuitively obvious nor conclusive but the data suggests that fishing pressures, among other possibilities, in the Boyle reach may have reduced the numbers of older age class trout. An in-depth scale analysis would shed some light on this question.

As a side note, the number of fish captured and intensity of the spring migration was much greater in 1959-62. This may also reflects possible effects of fishing pressure on the population of trout below the Boyle powerhouse. If, however, the fishing pressure is as intense as stated, more tag recoveries should have been experienced during the 1988 season especially considering the number of tags that were introduced from both ODFW and Beak personnel. Two possibilities exist with that scenario. One, a majority of tags were not returned by anglers or two, mortality was high for tagged individuals. An increase in creel censusing activities in the Boyle reach might answer these questions in part.

The destination of trout migrating over Boyle Dam has not been determined. Trout tagged at the Boyle ladder and released above the dam were not sampled at Spencer creek nor were the Boyle trout nearly as large as the spawners observed in the creek. It is speculated that fish migrating from the Boyle reach spend a year or more in the reservoir prior to migrating up Spencer Creek above Boyle Dam to spawn. Placement of a trap in the creek has been proposed to determine the movements of spawning trout within the creek and the fate of their progeny.

Another notable point in the 1988 trapping season was the lack of migrating trout at Link River ladder. Despite many large individuals being captured and tagged during salvage operations, only three individuals passed the Link ladder. Electrofishing surveys indicated that no trout were present below the ladder as well. The presence of the remnant 'Klamath Falls' below the project may be the cause for reduced numbers of upstream migrants as passage seems improbable at certain times of the year. Just as probable is the possiblilty that fish don't migrate from Lake Ewana to Upper Klamath Lake. Improvement of passage conditions at the falls and more intense sampling of Link River below the falls may answer these questions.

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Appendix C

Genetic Differences in the Life Histories of Rainbow Trout (*Oncorhynchus mykiss*) East of the Cascade Mountains

by

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ABSTRACT

Significant differences in the mean and variance of hatching times between the progeny of experimental strains of rainbow trout collected from contrasting environments within the Upper Klamath Lake Basin are evidence of paternal differences in the genetic control of hatching time and suggest that differences may also exist for other quantitative traits.

Introduction

Although knowledge of the relationship of geographical variation in behavior to patterns of morphological and biochemical variation is critically important for genetic conservation and management of native fishes, it remains unknown. Biochemical and morphological data are useful for identifying genetically discrete groups for management (Allendorf et al. 1987) and examining evolutionary relationships (Buth 1984) and have been collected for many groups (e.g., Allendorf 1975, Milner et al. 1980, Parkinson 1984, Schreck et al. 1986, Berg 1987). However, the genetic bases and evolutionary patterns of complex ecological and physiological behaviors (i.e. life history traits) among these groups have been only poorly documented (references in Ricker 1972, Tave 1986). Such variation, if it is genetic, will be conserved if all genetically discrete groups can be identified and each is protected as a separate unit. Without knowledge of the relationship between genetic variation in life history traits and other taxonomic characters, possible genetic differences in ecological or physiological behavior may be lost by the management of otherwise similar groups as single units.

The purpose of this research is to determine (1) whether genetically different life history patterns exist among populations of rainbow trout (*Oncorhynchus mykiss*) within and between basins and (2) whether biochemical or morphological differences can be used to indicate differences in life history patterns. During the first year of this study, the groups to be studied were identified, rainbow trout were collected for analysis of biochemical variation, and inheritance studies of behavioral variation were begun.

ACTIVITIES

Study Areas

Rainbow trout in the Upper Klamath Lake and Harney basins provide an excellent opportunity for study. The patterns of genetic differences among rainbow trout of these basins have not been documented. In the absence of gene flow, genetic drift and natural selection may have resulted in to genetic differentiation for biochemical and life history traits. No known hydrological connection has existed between the drainages since the Pleistocene, although both drainages show faunal relationships to the Columbia River (Minkley et al. 1986). Both basins have similarly diverse semi-arid habitats, including large, shallow lakes, major rivers, and spring-fed creeks, that are subject to large daily and seasonal fluctuations in water level, temperature, dissolved oxygen, and alkalinity.

Rainbow trout from two different environments within the Upper Klamath Basin - Spring Creek and Deming Creek - were the subject of this year's activities. Spring Creek flows from an elevation of 1270 m for 3.5 km with an average width of 50 m and slope of 1.4% over the ancient lakebed of Upper Klamath Lake. Almost entirely fed by springs, which maintain constant flow and temperature, Spring Creek enters the Williamson River 8 km above the confluence of the Sprague River and 26 km above Upper Klamath Lake. Mature rainbow trout enter the stream from October to May, where they can be observed spawning, but otherwise do not reside in the stream. Gravel beds are re-used for constructing redds. At an unknown age, juveniles also emigrate.

Deming Creek flows from an elevation of 2170 m on the southwestern slope of Gearhart Mountain to join the South Fork of the Spraque River 140 km above its confluence with the Williamson River. It is 23 km long with an average width of less tha 4 m. Most of the lower 16 km of Deming Creek have been trenched or diverted and are uninhabitable for rainbow trout. In the upper 7 km near the Gearhart Wilderness Area, where the gradient increases from 1.2% to nearly 10%, the stream is more pristine and inhabited by populations of rainbow trout and bull trout (Salvelinus confluentus). Rainbow trout spawn during a short period in late April, when some mature fish also reenter the stream through irrigation ditches from a small irrigation pond. Although non-native hatchery rainbow trout have been released in Spring Creek, I could found no evidence of introductions of rainbow trout in Deming Creek.

Biochemical and Morphological Analyses

In the Upper Klamath River basin, samples of rainbow trout from Pothole, Brownsworth, Whitworth, Leonard, Coyote, Buckboard, Long, Deming, and Spring creeks were collected for taxonomic analysis. Rainbow trout were also collected from Cottonwood, Dinner, and Black Canyon creeks and the Little Blitzen River in the Harney basin.

Inheritance Studies

To produce the progeny that will tested for genetic differences in behavior, nine female rainbow trout from Spring Creek were mated to nine males from Spring Creek and nine males from Deming Creek on 29 April 1988, using all possible 162 combination. Mature rainbow trout from

Spring Creek had been collected by seining on 20 and 28 April and held at the Klamath Hatchery, until mature males from Deming Creek could be collected by electrofishing on 28 and 29 April. Sperm from each Deming Creek male were collected at Deming Creek on 29 April, stored at 4.5C in separate containers over ice and transported to the Klamath Hatchery. Sperm were immediately collected and stored in a similar manner from Spring Creek males, while eggs from each Spring Creek female were collected and divided into 18 equal portions. Families were created by adding equal amounts of sperm from a different male to each portion. Eggs in each family were transfered to 51 mm incubation cells (McIntyre and Blanc 1973) and randomly ordered in a trough for incubation at 6.7C at the Klamath Hatchery. On 4 June, after dead and unfertilized eggs had been removed, the remaining eggs in each cell were covered with moist cheese cloth and the cells were randomly ordered in cool styrofoam boxes over ice and transfered to the aquaculture facilities at Oregon State University. Here, the cells were randomly ordered in drip incubation trays at 10C. With the onset of hatching on 7 June, the number of hatched eggs in each family were counted at approximately eight hour intervals until all were hatched. We tested for equality means and variances, using the separate variance *t*-test and Levene W-test, respectively, that were available in BMDP Statistical Software package (Anonymous, 1985).

RESULTS AND DISCUSSION

Significant differences in the mean (P = 0.00) and variance

(P = 0.00) of hatching times between the progeny of Spring Creek x Spring Creek and Spring Creek x Deming Creek matings are evidence of paternal differences in the genetic control of hatching time (Fig. 1). Although genetic differences in hatching time between groups of rainbow trout have not previously been demonstrated, they should be expected. McIntyre and Blance (1973) noted significant additive variation for eggs of rainbow trout incubated in troughs. Additive genetic variation in rainbow trout hatching in the wild could be altered by natural selection in different environments or the stochastic effects of small population size. Our results suggest that differences between rainbow trout from the two locations may also exist for other quantitative traits.

Hatching times of rainbow trout in Spring Creek and Deming Creek may also differ. However, such a conclusion is premature, without ecological evidence. Environmental differences between Spring Creek and Deming Creek may either increase or decrease the differences observed in the wild from those observed experimentally. Hatching times in the hybrid progeny of rainbow trout from these two populations may (1) be intermediate between later hatching fish in Spring Creek and earlier hatching fish in Deming Creek or (2) represent overdominance. Likewise, the action of different genes, which regulated hatching time under different environments (McIntyre and Blanc 1973), may determine phenotypic differences in the wild.

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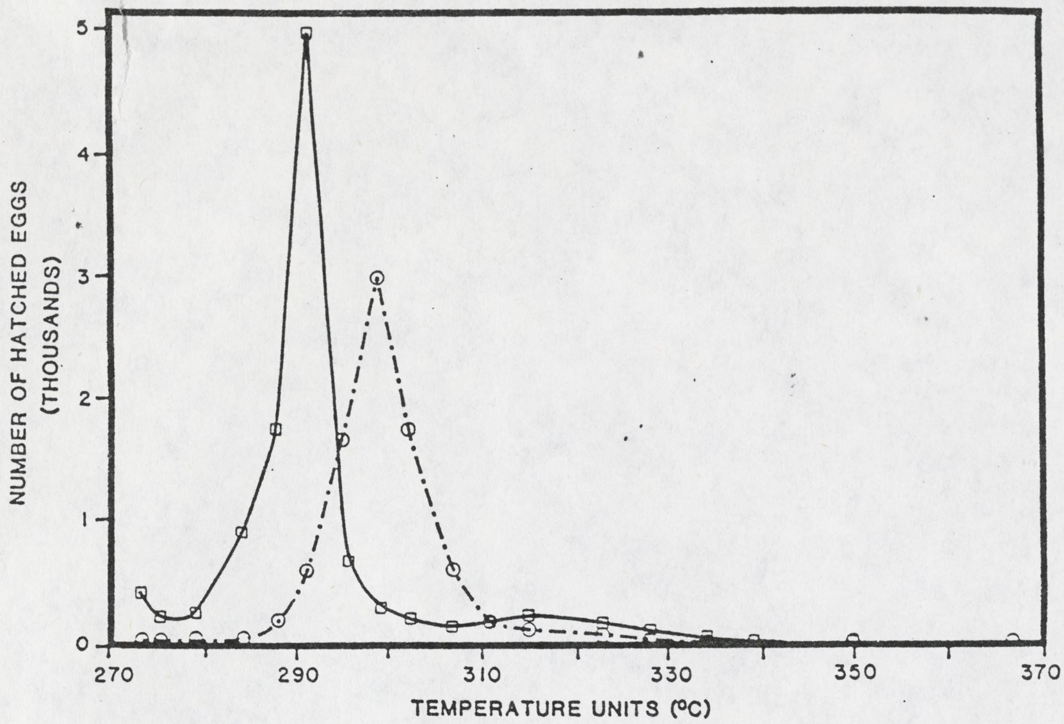

Fig. 1. Variation in hatching times for two experimental strains of rainbow trout, Spring Creek x Deming Creek (solid line) and Spring Creek x Spring Creek (broken line).