

Survival and Migration behavior of hatchery winter steelhead reared at three different densities

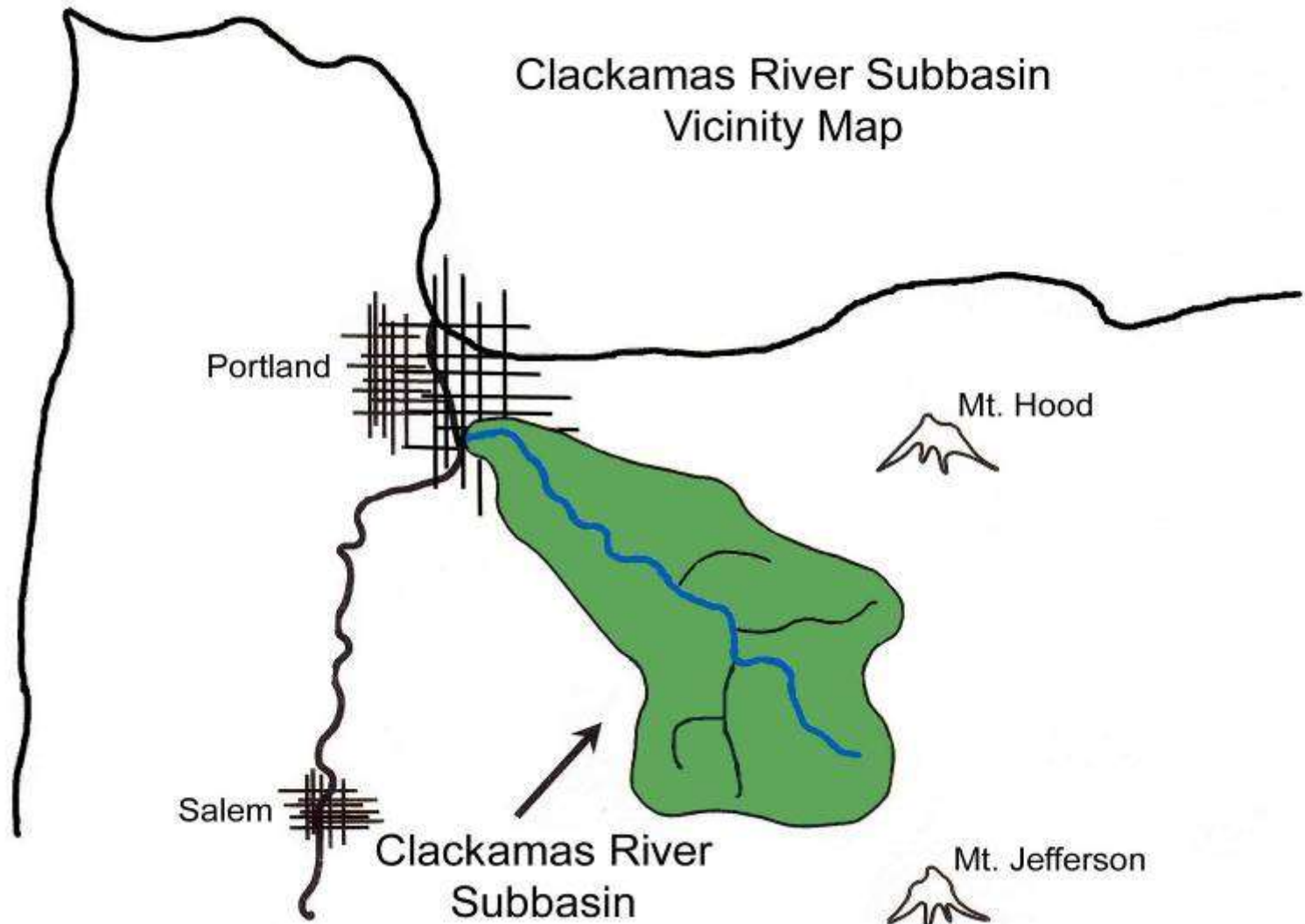


U.S. Fish and Wildlife Service
Columbia River Fisheries Program Office

CONSERVING
America's
Fisheries

Conserving America's Fisheries





U.S. Fish and Wildlife Service
Columbia River Fisheries Program Office

CONSERVING
America's
Fisheries

Conserving America's Fisheries



What we (think we) know

- Optimum emigration occurs when hatchery smolts released at lengths 190-199mm (*Fessler & Wagner (1969); Folmer & Dickoff (1981); Tipping (1997)*)
- Fish < 190mm at release had lower migration rates (*Folmer & Dickoff (1981)*)
- Between 19.8% and 65.5% of hatchery steelhead are nonmigrants (*Tipping et al.1995; Tipping and Byrne 1996*)
- Increased mortality and **residualization** can occur if fish do not migrate during release year (*Tipping et al 1995*)



U.S. Fish and Wildlife Service

Columbia River Fisheries Program Office



Conserving America's Fisheries



Study Objectives

- Evaluate **GROWTH**, **CONDITION**, and **SURVIVAL** of hatchery winter steelhead reared at different densities
- Evaluate **OUTMIGRATION BEHAVIOR** of hatchery winter steelhead reared at different densities



U.S. Fish and Wildlife Service

Columbia River Fisheries Program Office

CONSERVING
AMERICA'S
Fisheries

Conserving America's Fisheries



Methods

- Growth, condition, and survival evaluated for brood years 2004-2006
- Density groups, (7500, 15,000, and 22,500), replicated three times for a total of 9 raceways
- Fork length, weight, and condition factor determined at tagging and prior to release
- WST are fin clipped (adipose and right ventral) and CWT
- CWT (unique to each raceway group) used to evaluate adult survival
- Fish from each density group surgically implanted with coded radio-transmitters



U.S. Fish and Wildlife Service

Columbia River Fisheries Program Office



Conserving America's Fisheries



Expected return dates of juvenile winter steelhead for brood years 2004-2006

Brood Year	Tag Date	Smolt Release	Return Year
2004	July 2004	April 2005	Jan.-March 2007& 2008
2005	July 2005	April 2006	Jan.-March 2008 & 2009
2006	July 2006	April 2007	Jan.-March 2009 & 2010



U.S. Fish and Wildlife Service

Columbia River Fisheries Program Office



Conserving America's Fisheries



Results

- **Density Index** ranged from

- 0.11-0.13 LOW
- 0.19-0.24 MEDIUM
- 0.28-0.37 HIGH

- **Condition Factor**

- 0.96-1.15 LOW
- 0.99-1.16 MEDIUM
- 1.00-1.22 HIGH



U.S. Fish and Wildlife Service

Columbia River Fisheries Program Office

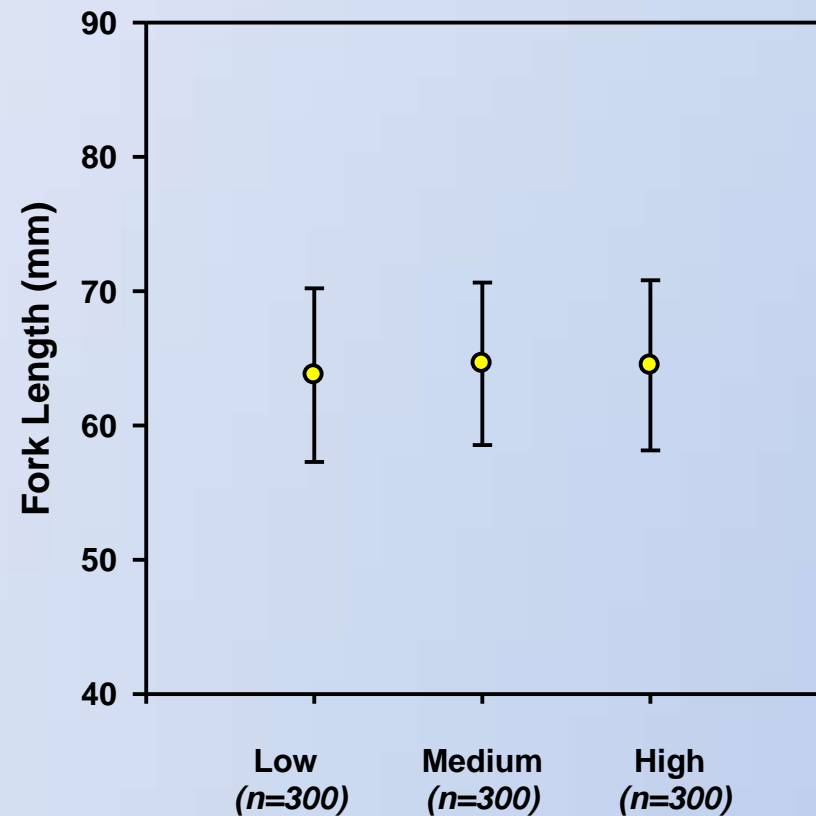
CONSERVING
AMERICA'S
Fisheries

Conserving America's Fisheries

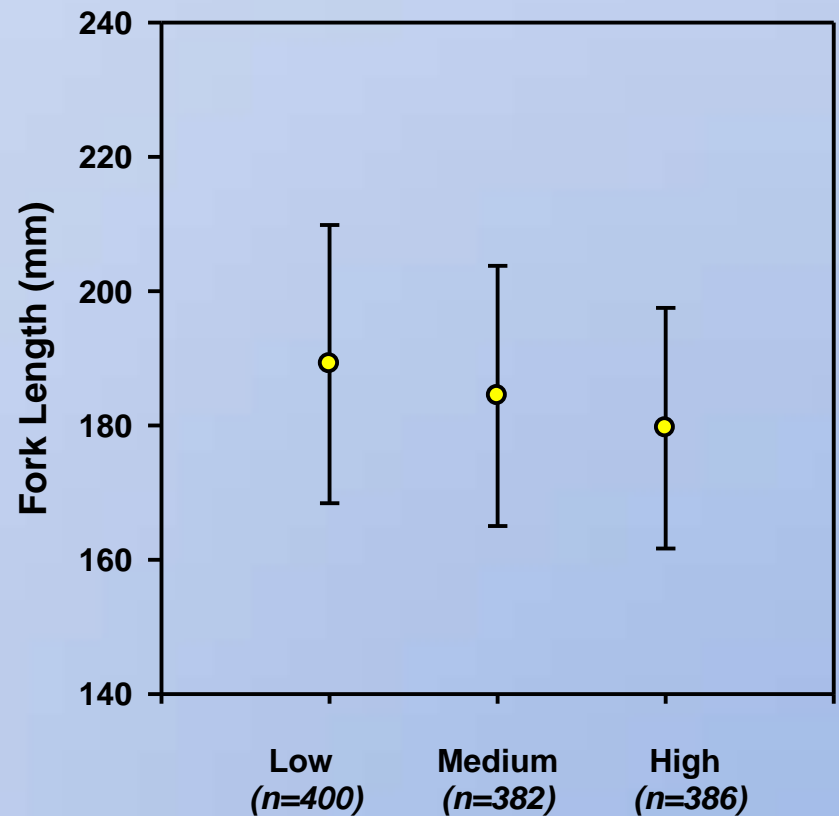


Growth

BY 2004 (Tagging)



BY 2004 (Release)



U.S. Fish and Wildlife Service

Columbia River Fisheries Program Office

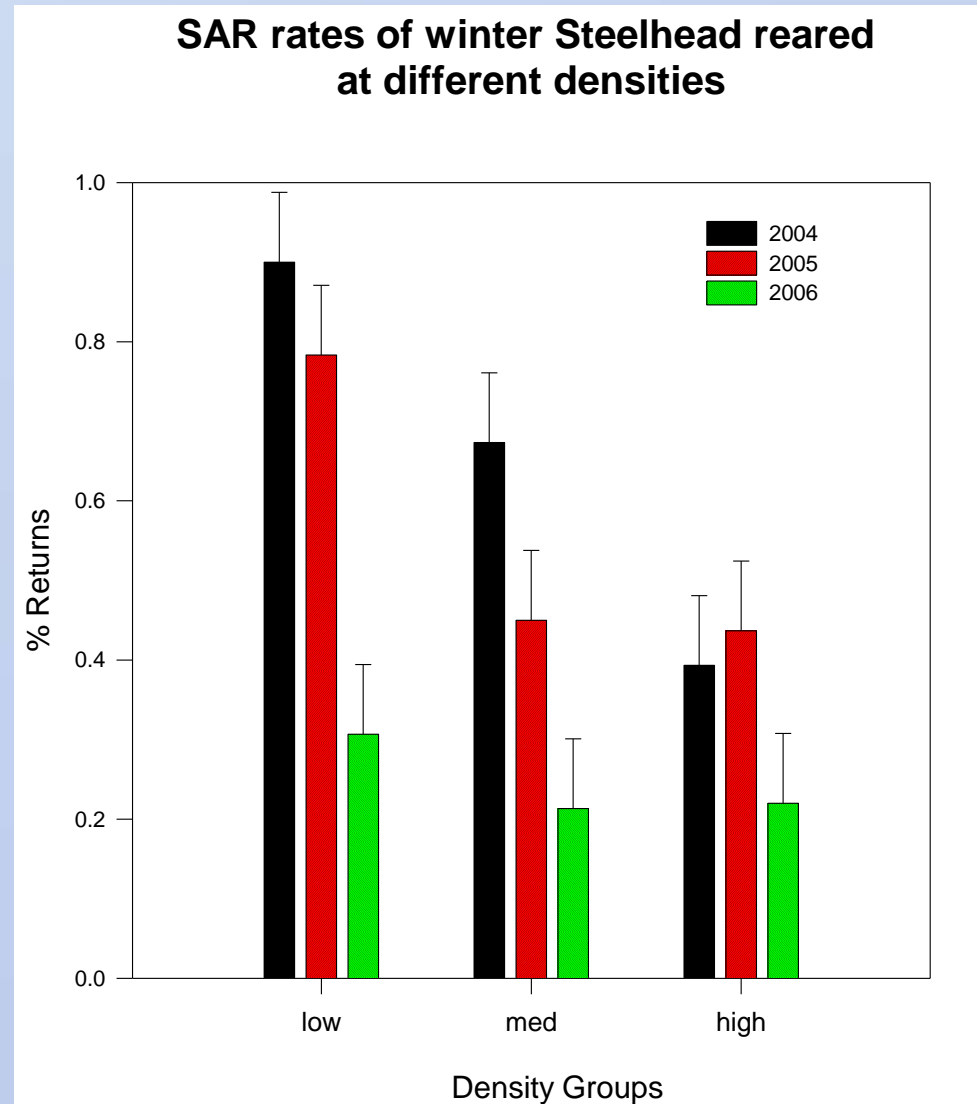
Conserving America's Fisheries

Conserving America's Fisheries



Differences?

- Significant effect of broodyear on SAR ($p < 0.001$). BY 2006
- Significant effect of Density on SAR ($p = 0.001$). Low density
- No interaction effect between BY and Density



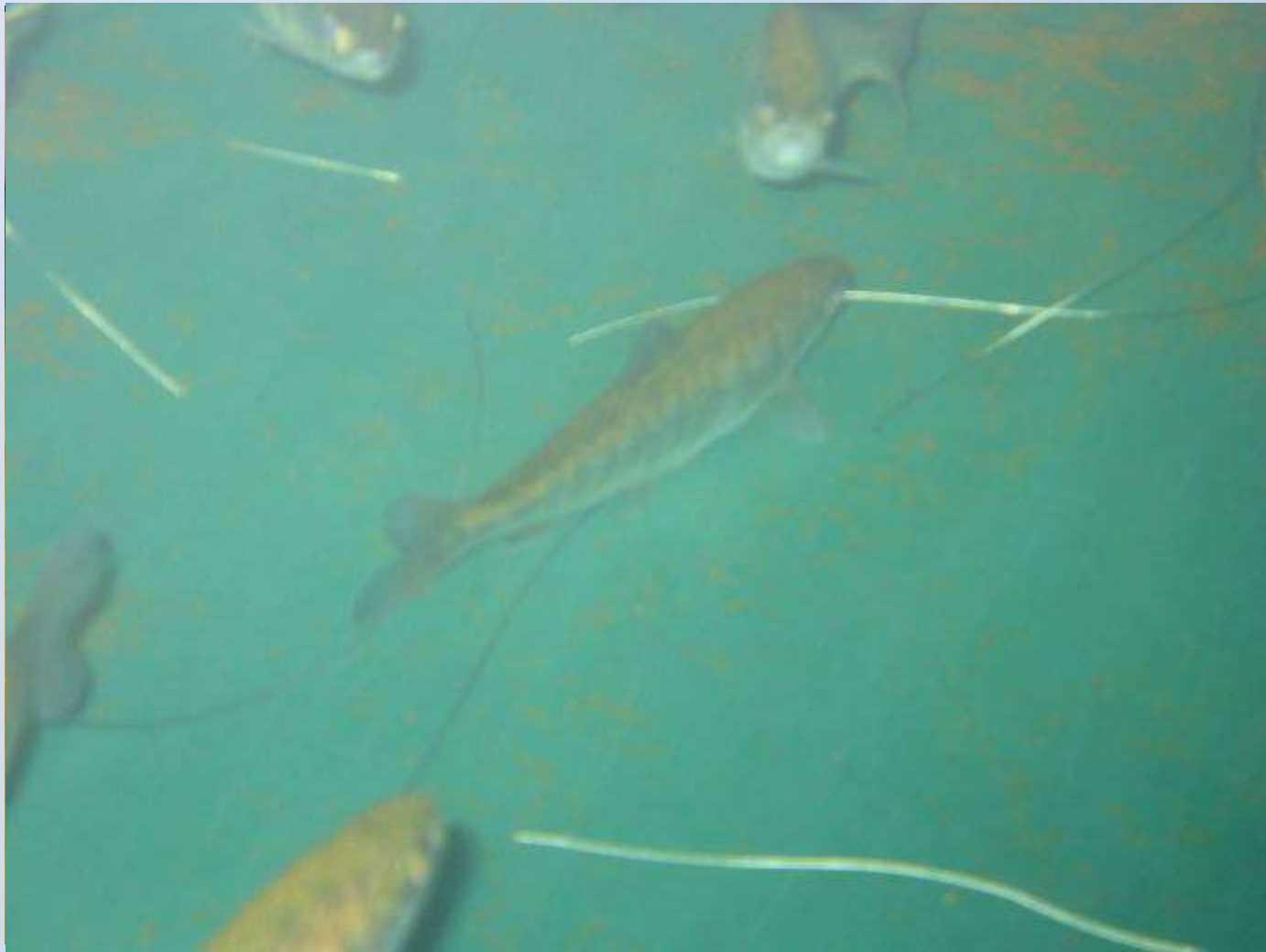
U.S. Fish and Wildlife Service

Columbia River Fisheries Program Office



Conserving America's Fisheries





U.S. Fish and Wildlife Service
Columbia River Fisheries Program Office

CONSERVING
AMERICA'S
Fisheries

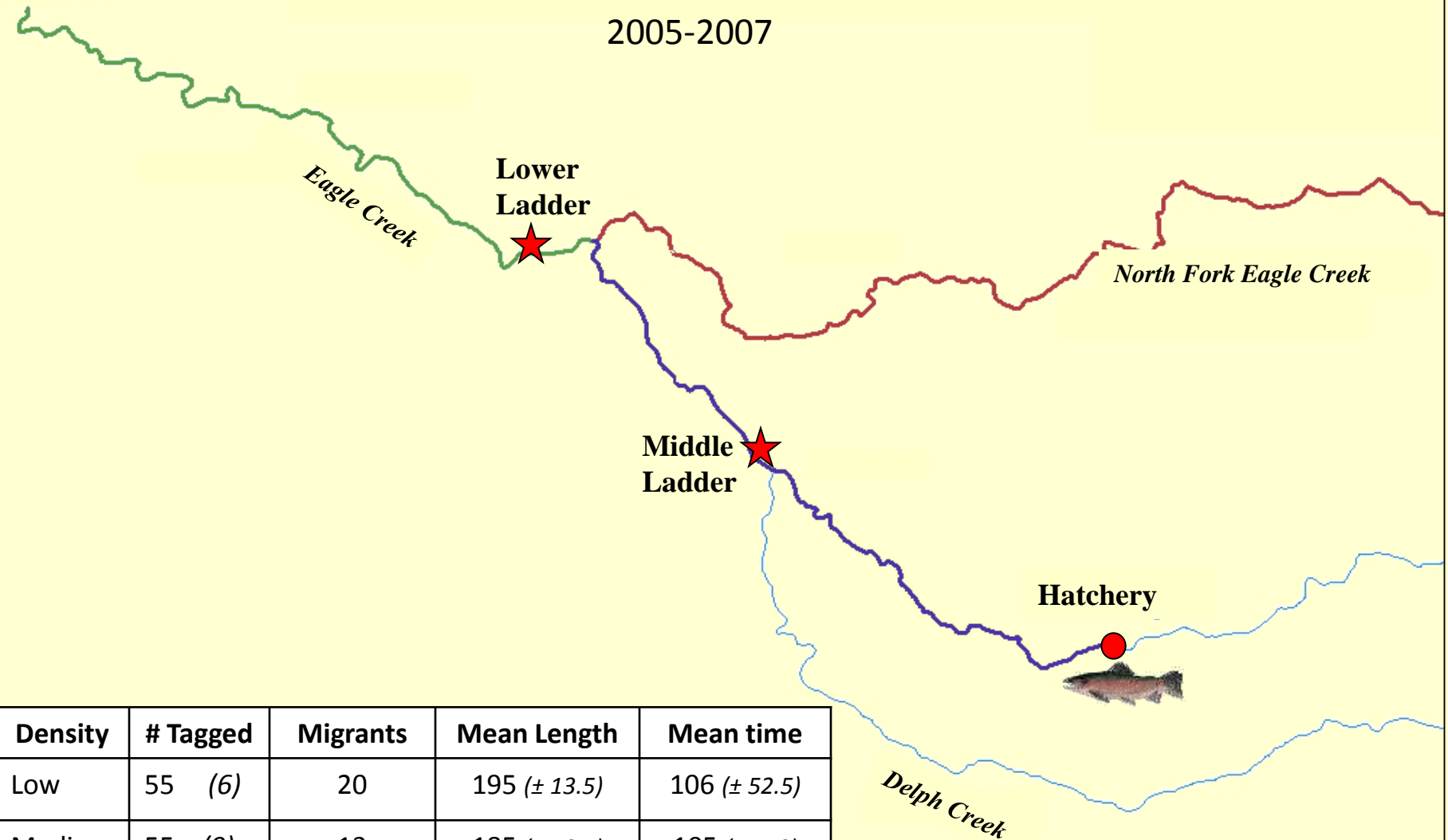
Conserving America's Fisheries



Migration Timing

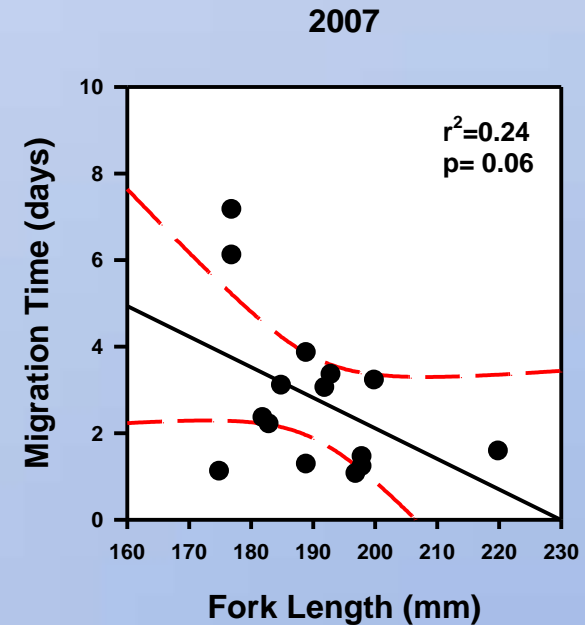
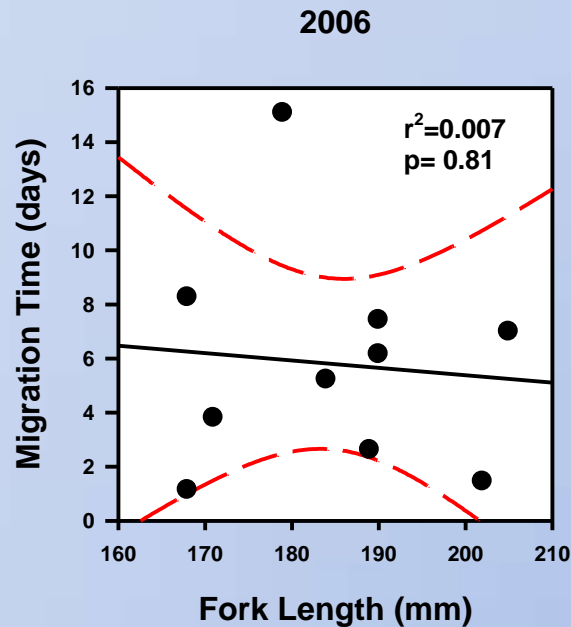
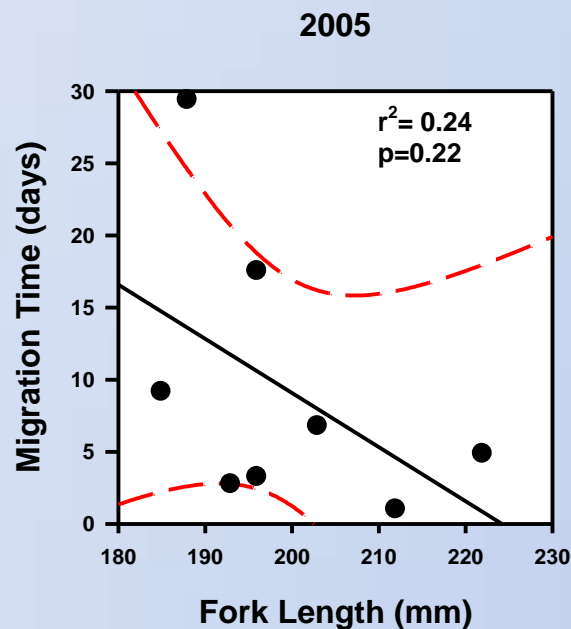
2005-2007

Mouth

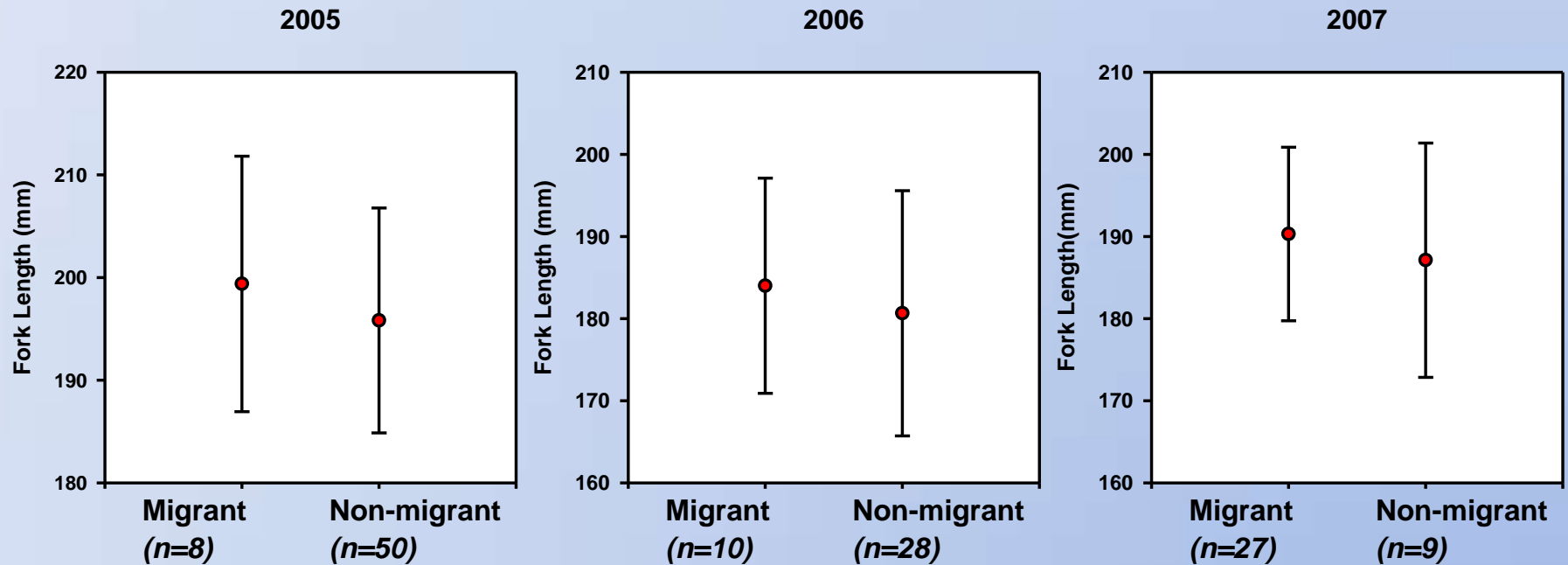


Density	# Tagged	Migrants	Mean Length	Mean time
Low	55 (6)	20	195 (± 13.5)	106 (± 52.5)
Medium	55 (9)	13	185 (± 10.1)	105 (± 110)
High	55 (5)	12	188 (± 9.7)	76 (± 47)

Fork length and Steelhead Migration



Mean fork length for migrant and non-migrant juvenile hatchery steelhead 2005-2007



U.S. Fish and Wildlife Service
Columbia River Fisheries Program Office

CONSERVING
AMERICA'S
Fisheries

Conserving America's Fisheries



What it all means

- Steelhead reared at lower densities had greater survival rates (SARs)
- Residual steelhead are present in Eagle Creek
 - Migrant fish left the system quickly (3-4 days), but nonmigrants constituted 32-71% of hatchery releases
 - No correlation between fork length and migration time



U.S. Fish and Wildlife Service

Columbia River Fisheries Program Office

Conserving America's Fisheries



Conserving America's Fisheries

Management Implications

- Reduce production-

- Steelhead program 150,000 → < 100,000

- Density Indices

- 0.18-0.20 (*around the medium density level*)

- Every facility has different needs

- Lower densities may yield greater survival, but you may not get the #'s needed for broodstock.



U.S. Fish and Wildlife Service

Columbia River Fisheries Program Office

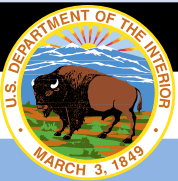


Conserving America's Fisheries



Acknowledgments

- USFWS-Columbia River Fisheries Program
- Eagle Creek National Fish Hatchery
- Lower Columbia River Fish Health Center



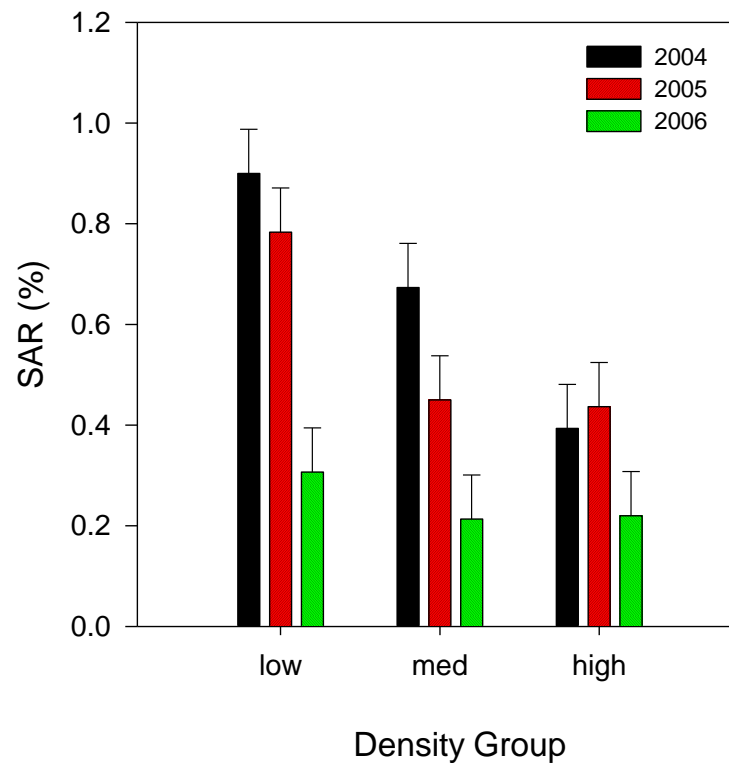
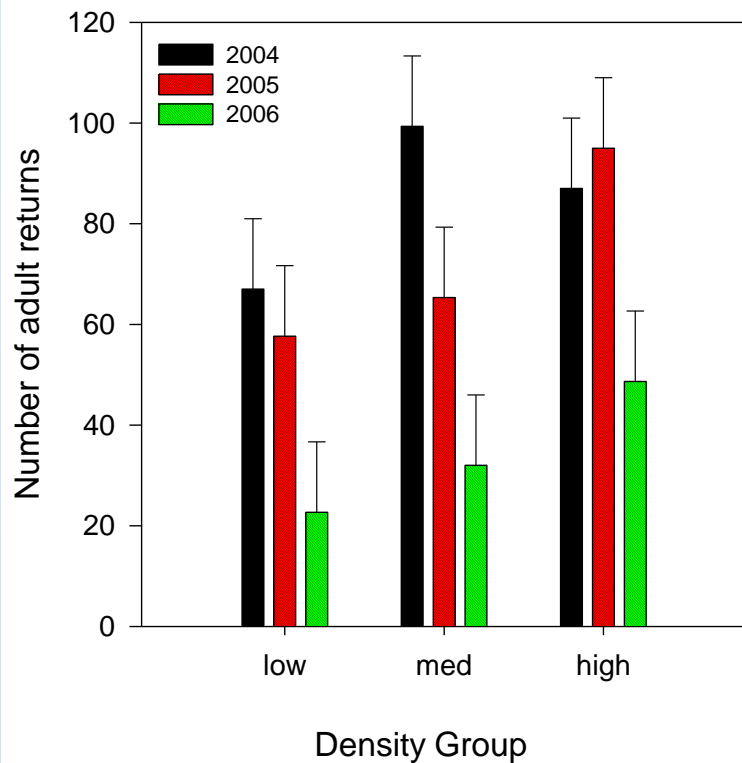
U.S. Fish and Wildlife Service

Columbia River Fisheries Program Office

CONSERVING
AMERICA'S
Fisheries

Conserving America's Fisheries





U.S. Fish and Wildlife Service
Columbia River Fisheries Program Office



Conserving America's Fisheries

