

# Preserving and Perpetuating Chinook Salmon: Genetic Diversity in a Northeast Oregon Captive Broodstock Program

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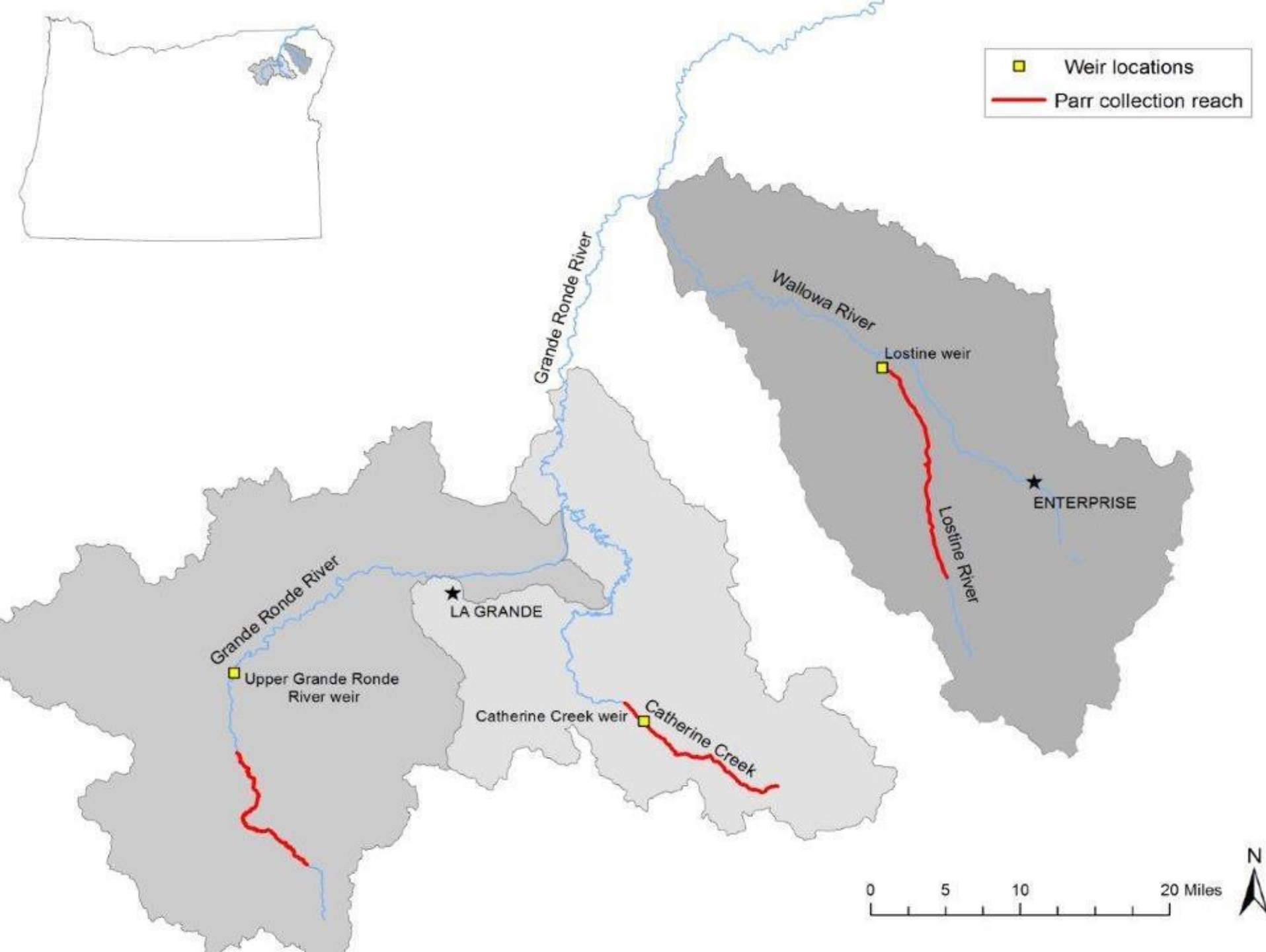
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ODFW Photo  
Collections





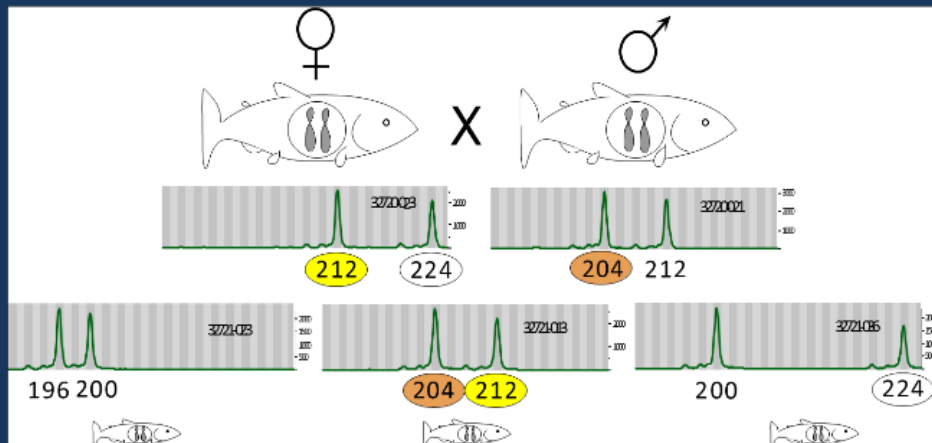


# Captive Broodstock (CBS) Story

- Once-productive populations fell to historically low levels in 1994 and 1995
- Objectives of CBS:
  - Provide demographic boost in nature
  - Preserve genetic resources of the population
- Collected natural parr for broodstock
- Held to sexual maturity, then spawned
- Released offspring as smolts in natal streams
- Did not use returning CBS adults as brood

# Methods

- Annual broodstock collection; genetic samples taken
- Genetic samples represented all sexes, rearing types (FW and SW), growth treatments, and causes of mortality (spawning; disease; other)
- 10 standard Chinook GAPS microsatellites
- 1998, 2000-03, and 2005 cohorts; 3,031 individuals
- Standard diversity tests



# Why is diversity important?

- Genetic variation is our bank; it's the pool of raw material that selection acts on
- More diversity = greater potential for a population to adapt to environmental change
- Critical for persistence, especially in the face of a rapidly changing climate

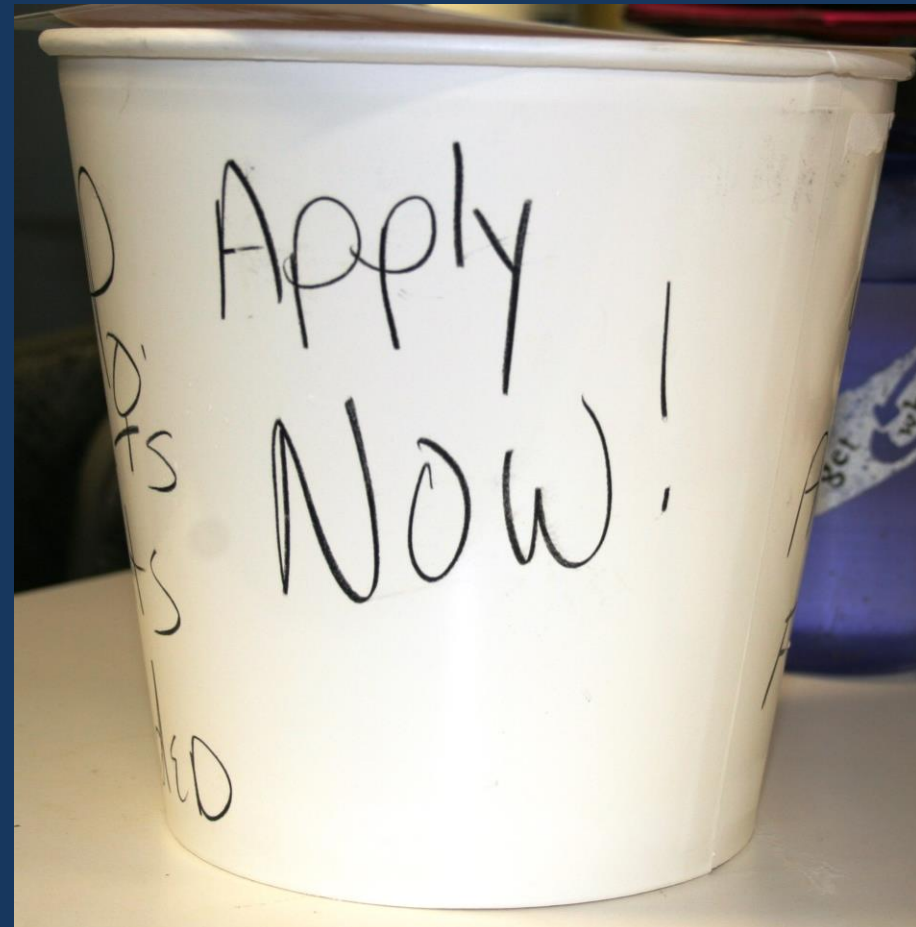
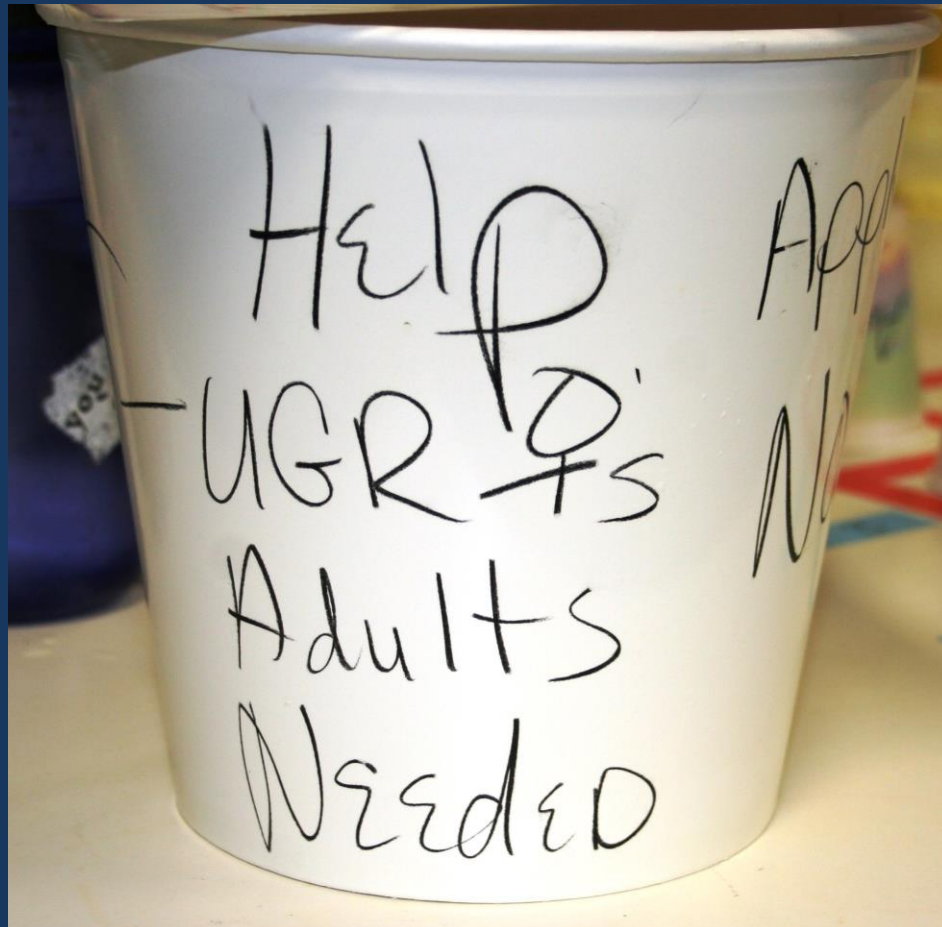


# Danger signs, UGR broodstock

Population	Cohort	N (samples)	No. parents of samples	Estimated no. parents/brood
CC	1998	147	82	279/500
CC	2000	186	46	124/503
CC	2001	186	117	315/500
CC	2002	183	176	493/513
CC	2003	188	221	588/500
CC	2005	183	103	168/300
UGR	1998	207	25	60/500
UGR	2000	169	28	83/500
UGR	2001	82	20	112/461
UGR	2002	192	7	18/503
UGR	2003	175	22	63/500
UGR	2005	125	50	120/300
LR	1998	88	48	272/498
LR	2000	182	51	141/503
LR	2001	178	65	183/500
LR	2002	183	143	391/500
LR	2003	191	174	455/500
LR	2005	186	132	207/292



# MatchFish.com, Marla Chaney style



# Results

- All CBS populations: no difference in genetic diversity between earliest (1998) cohort and 2005 cohort of broodstocks;  $P \geq 0.3010$
- Diversity of the 2008 UGR cohort was not different from UGR 1998 cohort;  $P = 0.3220$
- Diversity of *smolts released* from the 2008 brood year was equal to ( $P \geq 0.1193$ ; CC and LR) or greater than ( $P = 0.0040$ ; UGR) diversity of *smolts released* from the 1998 brood year



# Why was diversity maintained? Contributing factors and protocols





# 1. Careful parr collection techniques

















## 2. Unique life history of CBS fish; differential age at maturation





# Spawning scenarios – 2002 cohort



- Age 4 - spawned in 2006
  - Males from 04, 03 cohorts
- AND
- Age 5 - spawned in 2007
  - Males from 05, 04 cohorts



- 2006 and 2007 BYR offspring



- Age 2 - spawned in 2004
  - Females from 00, 99 cohorts
- AND
- Age 3 - spawned in 2005
  - Females from 01, 00 cohorts



- 2004 and 2005 BYR offspring

### 3. Factorial (matrix) spawning

















T3

09/16/2009 08:03



Female

Female B

Female C

Female D

Male 4

A 4

B 4

C 4

D 4

Male 3

A 3

B 3

C 3

D 3

Male 2

A 2

B 2

C 2

D 2

Male 1

A 1

B 1

C 1

D 1



10/02









30 seconds  
'cause you can't  
hurry love.





# Conclusions

- CBS populations maintained their genetic diversity from the 1998 through the most recent cohorts (2005 CC and LR; 2008 UGR)
- Brood year 2008 *offspring* maintained diversity of brood year 1998 *offspring*
- Factors we believe contributed to success:
  - Careful parr collection
  - Differential age at maturation
  - Matrix spawning protocols



