8th Spring-run Chinook Symposium

July 26-28, 2016 in Chico, CA
Session Overview

- Sponsors:
  - PG&E
  - Northern California Water Association
  - Friends of Butte Creek
  - California Conservation Corps

The year’s Symposium will highlight regional status reports on Spring-run Chinook populations, instream flow studies and fish passage assessments, water conservation and transactions, and how to translate research and genetics into implementation and recovery actions. Field tours will include visits to the legendary spawning grounds in Upper Butte Creek and PG&E’s hydroelectric retrofit projects; salmon and steelhead fish passage in Lower, Deer, Mill and Antelope Creek that have been prioritized for instream flow enhancement and fish passage projects; a Clear Creek Spring Chinook Restoration tour; and a tour of Lower Butte Creek Water Diversions.
Presentations

Monitoring and Status of Spring-run Chinook Reports
(Slide 4) Mill, Deer, and Antelope Creeks Monitoring Status Reports
Matt Johnson, California Department of Fish and Wildlife

(not included) Movement and Survival Rates of Wild Chinook Salmon Smolts from Mill Creek to the San Francisco Bay 2013 – 2015
Jeremy Notch, Southwest Fisheries Science Center, NOAA Fisheries

(Slide 26) Movement and Survival Rates of Butte Creek Spring-run Chinook Salmon Smolts from the Sutter Bypass to the San Francisco Bay
Flora Cordonleani, Ph.D., Southwest Fisheries Science Center, NOAA Fisheries

(Slide 50) Clear Creek and Battle Creek Spring-run Restoration Actions and Population Status
Matt Brown, Clear Creek and Battle Creek Program, Red Bluff Fish and Wildlife Office, U.S. Fish and Wildlife Service

(Slide 95) Spring-run Chinook Population Trends on the Upper Klamath, Trinity, and Salmon River
Mike Belchik, Senior Scientist, Yurok Tribe
Mill, Deer, and Antelope Creek Spring-Run
Chinook Monitoring
Matt Johnson
CDFW
Spring-Run Monitoring
Recent monitoring results:

<table>
<thead>
<tr>
<th>Year</th>
<th>Antelope video</th>
<th>Antelope snorkel</th>
<th>Deer video</th>
<th>Deer snorkel</th>
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Antelope Creek SRCS population trends
Deer Creek SRCS population trends

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Mill Creek SRCS population trends

Year

Total Spring-Run Chinook

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<td>768</td>
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Stating the obvious: Recent Deer and Mill spring-run counts are abysmally low.

Why are Butte Creek spring-run doing better?

Are current recovery efforts enough?
Lake Shasta May, 2016
River-Miles
240-220

Butte Creek Confluence
River Mile 80
Sutter Bypass March, 2016

Photo credit: Alex McHuron NOAA
M&T, 3B’s, Goose Lake

Moulton Weir, Colusa Weir
Acknowledgements:
Curtis Milliron, Brad Henderson, Jason Roberts, Doug Killam, Sam Plemons CDFW
Stan Allen, Ryan Revnak, Byron Mache, Brendan Barney PSMFC
Sean Heyes, Arnold Ammond, Jeremy Notch, Alex McHurron NOAA

End
Movement and Survival rates of Butte Creek spring-run Chinook salmon smolts throughout their migration to the Ocean

8th Spring-run Chinook Symposium
July 26, 2016

Flora Cordoleani, Arnold Ammann, Jeremy Notch and Alex Mc-Huron

UC Santa Cruz – NMFS/NOAA Santa Cruz
Central Valley spring-run Chinook viability status

- Only 3 out of 18 or 19 historic independent populations of CV spring-run Chinook salmon are extant: Mill, Deer, and Butte creeks
- Represent only the Northern Sierra Nevada diversity group
- Listed as threatened under the federal Endangered Species Act (ESA) since 1999.
The status of the CV spring-run Chinook salmon ESU has probably improved on balance since the 2010 status review, through 2014, with Mill and Deer Creek populations improving from high extinction risks to moderate extinction risks. Butte Creek, has remained at low risk, and all viability metrics had been trending in a positive direction, up until 2015.

“The recent declines of many of the dependent populations, high pre-spawn and egg mortality, and uncertain juvenile survival during the 2012 to 2015 drought, ocean conditions, as well as the level of straying of FRFH spring-run Chinook salmon to other CV spring-run Chinook salmon populations are all causes for concern for the long-term viability of the CV spring-run Chinook salmon ESU.”

[Johnson and Lindley, SR viability report (2016) and NOAA-NMFS 5 year status review report (2016)]
Juvenile salmon survival during rearing and outmigration to the Ocean
Butte Creek & Sutter Bypass

- Butte Creek originates in the Lassen National Forest
- Butte Creek is connected to the Sacramento River through the Butte Slough outfall gates and the Sutter Bypass
- Sutter Bypass = Floodplain of 40km composed of two canals (East and West borrow)
- Moulton, Colusa and Tisdale weirs spill water from the Mainstem into Butte Creek system
- Important rearing habitat for Butte Creek Chinook salmon juveniles
Study site: Sutter Bypass Weir 2
Acoustic tagging study

- Juvenile Salmon Acoustic Telemetry System (JSATS)
- Smolts > 80 mm

0.28g and 0.3g Lotek JSATS acoustic tags
Receivers Map

- 500 Km array of acoustic receivers
2015 vs 2016 tagged fish

- 141 fish tagged between April 6 - 16 2015
- 200 fish tagged between April 14 - 18 2016

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<th>n</th>
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<th>Length – mm (SD)</th>
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<td>141</td>
<td>13.47 (5.36)</td>
<td>104.75 (12.28)</td>
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<td>2016</td>
<td>200</td>
<td>16.68 (7.68)</td>
<td>110.02 (10.93)</td>
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2015 detections map
Simplified receivers map
Cormack-Jolly-Seber survival model

- Reach-specific survival rates and detection probability estimated with a spatial form of the Cormak-Jolly-Seber (CJS) model (RMark library)

- Covariates: fish length, fish weight, water temp at release, water temp at each detection site

- Best Model:

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<th>p</th>
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2015 survival estimates
2015 migration pattern and movement rate
2015 vs 2016 real time travel time

- Real time receiver at Tower Bridge (rkm 172)
Genetic Assignment. SR vs FR

2015

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<tr>
<th>Group</th>
<th>min</th>
<th>max</th>
<th>Mean</th>
<th>sd</th>
<th>freq</th>
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<td>84</td>
<td>135</td>
<td>113.6</td>
<td>14.1</td>
<td>10</td>
</tr>
<tr>
<td>CV spring-run</td>
<td>80</td>
<td>136</td>
<td>104.1</td>
<td>11.7</td>
<td>129</td>
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</tbody>
</table>

2016 (200 tagged fish + 34 sampled fish)

<table>
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<th>min</th>
<th>max</th>
<th>mean</th>
<th>sd</th>
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<td>122</td>
<td>102</td>
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Fork Length (mm) Frequency

CV Fall-run
CV Spring-run

Fork Length (mm) Frequency

CV Fall-run
CV Spring-run
### Genetic Assignment. CV stocks 2015

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<tr>
<th>Group</th>
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<td>109.7</td>
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![Histogram of Fork Length (mm) for different CV stocks](chart.png)
Genetic Assignment. CV stocks 2016

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![Graph showing fork length distribution for different groups](image)
Take home message

- 2015 was a very dry year and Butte Creek spring-run smolt survival was very low, especially in two reaches of the Sutter Bypass that could be caused by detection issues and fish confusion

- Preliminary results for 2016 show that tagged fish are bigger and migrating faster to the Delta than in 2015

- More FR than SR fish tagged in 2016 (7% of FR in 2015 vs 63% in 2016)
Proportion of Chinook salmon coming from the Mainstem to the Bypass is higher in 2016 than in 2015 (25% in 2015 vs 30% in 2016)

Source: CDEC

Source: Alex McHuron
Future directions

- Keep performing acoustic study to compare survival obtained for different water type year, assess the impact of drought events
- Expand Butte Cr. spring-run Chinook salmon monitoring program to evaluate juvenile production and survival in upper Butte Creek watershed and for smaller fish
- Evaluate the rearing potential in the lower Butte Cr. system for different flooding scenario
Many thanks to:

• UCSC
• NMFS/NOAA
• US Bureau of Reclamation
• CA Department of Water Resource
• CA Department of Fish and Wildlife

Funding: USBR Drought Grant
### Genetic Assignment. CV stocks 2016

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62 fish have a Numloc>90 & FullEM >80

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Clear Creek and Battle Creek Spring Chinook Status and Restoration Actions

Matt Brown
USFWS, Red Bluff
July 26 2016
Battle Creek

- Adult Counts
- Decreased Spawning Success
- High Temperatures
- Wildcat Dam Removal!
- Ponderosa Fire Disaster
- Closing off South Fork
- Natural Barriers
- Future Plans and Actions
- Genetics
Battle Creek Spring Run Escapement
Decreased Spawning Success
Lower Percent Redds Per Salmon
South Fork Battle Creek Multiannual Temperature Comparison May 1-Nov 1

Temperature (°F)

- 2013
- 2014
South Fork Battle Creek Multiannual Temperature Comparison May 1-Nov 1
Wildcat Dam Removal 2010
Monitoring Salmonid Passage at Natural Barriers

- Increased flows for passage
- Monitor live fish and redd distribution
- Total barrier blown up 2012
Low Flow Barriers

• Measure geometry, water velocity, water depth
• Photo points
• Revisit periodically
• Passage better in wetter years
• Need More Flow!
Battle Creek: The Nature Conservancy Easements
Ponderosa Fire: August 31 2012

Legend
- Dams
- River Miles
- TNC_Lands_California
- BattleCreek

Ponderosa Fire 8/2012

TNC_Lands_California: http://www.tnclands.tnc.org/
Ponderosa Fire: http://activefiremaps.fs.fed.us/burnscar.php
Ponderosa Aftermath
Coleman NFH Barrier Weir
Battle Creek Turbidity per CFS Discharge at Juvenile Fish Trap
Holding and Spawning Habitat Filled With Sand
Used Weir to Close off South Fork
Upcoming Plans, Actions, and Challenges

- Winter Chinook Reintroduction Plan
- Coleman National Fish Hatchery Adaptive Management Plan—studies forthcoming
- New Fish Trap and Fish Sorter

- Phase 2 of Battle Creek Restoration Project
  - Physical modeling of new fish screen and fish ladder
  - Final designs being developed
  - Construction in 2018
- Removal of four dams

- Getting Higher Flows in North Fork
- Opening Up the New Fish Ladder @ Eagle Canyon
New Fish Screens and New Fish Ladders
Genetic Distances Among Sacramento River Chinook-SNPS
Figure 1. Discriminant Analysis of Principal Components (DAPC) plot of individual spring run Chinook salmon. Baseline fish from Butte Creek (red) and Mill and Deer Creeks (both blue), are shown, as well as spring baseline fish from Clear Creek (yellow) and Battle Creek (green). The relative eigenvalues of the axes are shown, indicating that the first (x) axis accounted for most of the variation.
Clear Creek Spring Chinook

- Adult Counts
- Poor Distribution
- Temperatures
- Successful Juvenile Production
- Pulse Flows to Attract Adults into Clear Creek
- Resistance Board Weir
- Habitat Construction?
Spring Chinook Snorkel Counts

Annual Spring Run Chinook Salmon August Index, Clear Creek, CA 2003-2015.
In 2015 Only 27% of SCS Upstream of Igo Gage- Has Averaged 54%
2015: Warmest Summer Water Temperatures Yet

Whiskeytown Outflow into Clear Creek - Mean Daily Water Temperature

- 2014
- 2015
- Average
Temperatures During Spring-run Spawning 3⁰F Lower in Clear Creek

Mean Daily Temperature (F)

100% Mortality (>62)
50-80% Mortality (<60 to ≤62)
15-25% Mortality (>58 to ≤60)
< 8% Mortality (>56 to ≤58)
Optimum Incubation (≤56)

Sac at Keswick
Clear at Whiskeytown
Spring-run Juvenile Productivity

- Values: 0, 500, 1,000, 1,500, 2,000, 2,500, 3,000, 3,500, 4,000
- Percentage: 27%, 36%
2013 Clear Creek Pulse Flow
Spring Chinook Adult Monitoring

- Spring run daily passage
- Maximum daily flow (cfs)
- Cumulative video
- Snorkel counts

- Pulse Flow 1
- Pulse Flow 2

August Index
Held Up Pretty Well
And No Carcasses
Thanks For the Fishes!
Spring Run was the Dominant Run in the Klamath and Trinity Rivers

The spring migration,\(^1\) granting that it was once very pronounced, has now come to be limited as to the number of individuals, and is of relatively little economic importance. The fish of this run begin to materially increase in numbers in the latter part of March or early in April and the migration has reached its maximum, and waned before the middle of June. The river at the time of the spring migration is apt to be in a condition of maximum flood\(^2\) as indicated in figure 3,\(^3\) the
Salmon River Spring Salmon Stronghold

Spring Chinook and Summer Steelhead Counts in the Salmon River 1990-2015

- Spring Chinook
- Steelhead
Spring Chinook in Trinity River Tributaries
1998-2014
Threats to Spring-Run Chinook

- Presence of Dams (migration barrier)
- Juvenile Fish Diseases (C. shasta)
- Illegal poaching
  - Lack of public education and awareness
- Agricultural practices in the Shasta and Scott
- Marijuana cultivation
- Overharvest
- Large-scale sedimentation (i.e. South Fork Trinity)
- Climate Change
Restoration Efforts for Spring Chinook Salmon

- Klamath Dam Removal
- Habitat restoration in mainstem Trinity River including Large Woody Debris Placement
- Habitat Restoration in South Fork Trinity including Large Woody Debris Placement
- Community education in South Fork, and Salmon Rivers
- Suction Dredge mining moratorium
- Reinstatement of ecologically appropriate fire regimes in the Klamath Basin
- Permitting and control of illegal marijuana cultivation
REINTRODUCTION OF ANADROMOUS FISH TO THE UPPER KLAMATH BASIN:

AN EVALUATION AND CONCEPTUAL PLAN

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Dam Removal Status

- Amended KHSA signed in April 2016
- Provides for the removal of Iron Gate, Copco 1 and 2, and JC Boyle Dams with PacifiCorp to pay first $200m
- Transfer of facilities to new entity known as the Klamath River Renewal Corporation
- No federal funding involved
- 2020 timeline still the goal for removal
- All four facilities to be removed in a single winter period
Questions?