Shasta Reservoir Management for Water Temperatures

Proposed Action for the Coordinated Long-Term Operation of the CVP and SWP

April 21, 2021
Shasta and Trinity Divisions

• Facilities
  • Shasta and Keswick Dams and Reservoirs
  • Trinity and Lewiston Dams and Reservoirs
  • Carr and Spring Creek
  • Whiskeytown Dam and Reservoir

• Proposed Action Components
  • Seasonal Operations
  • Status and Trend Monitoring
  • Habitat and Facility Improvements
  • Hatchery Intervention
  • Special Studies
Shasta Cold Water Pool Management Framework

Hydrology & Meteorology

Operations

Habitat Restoration Infrastructure Improvements & Hatchery Actions

Actions for Storage (October – April)
- Carryover Storage
- Fall Flows
- Winter & Spring Flows
- Delta Requirements
- Flood Conservation Space
- Non-Project Water Rights

Actions for Water Temperatures (May-September)
- Keswick Releases
  - Shasta Releases
  - Trinity Imports
- Temperature Control Device Selective Withdrawal

For Discussion Purposes
Winter-Run Chinook Salmon

- Spawning, incubation, and emergence generally occurs May through November.
- Most winter-run spawn upstream of the Clear Creek confluence.
- Temperature-dependent mortality is believed negligible at water temperatures colder than 53.5°F*.
- Hydrology and meteorology does not provide enough cold water for 53.5°F below Keswick Dam in all years.
- The biology of egg incubation provides a strategy that can incorporate uncertainty in meteorology and hydrology.

*The 53.5°F DAT (daily average temperature) is the operational and modelled parameter to achieve the 57°F 7DADM (7-day average daily maximum) for the Sacramento River.
Shasta Cold Water Pool Temperature Tiers

- The tier depends on feasibility after the May 1 reservoir profile identifies the available cold water pool (CWP).

- Description of Tiers-Based Strategy:
  - Tier 1: $\text{CCR} \leq 53.5 ^\circ \text{F} \,(\text{CWP} > \sim 2.8 \text{ MAF}^*)$
  - Tier 2: $53.5 ^\circ \text{F} \text{ to } 56 ^\circ \text{F} \,(\text{CWP} < \sim 2.8 \text{ MAF}^*)$
  - Tier 3: $\text{CCR} > 53.5 ^\circ \text{F} \text{ but } \leq 56 ^\circ \text{F} \,(\text{CWP} > \sim 2.3 \text{ MAF}^*)$
  - Tier 4: $\text{CCR} > 56 ^\circ \text{F} \,(\text{Total Storage} < \sim 2.5 \text{ MAF})$

- The Sacramento River Temperature Task Group develops the schedule of target temperatures.

* The reservoir storage believed necessary to achieve downstream water temperatures is based on historical conditions. The tier in any particular year will depend upon measured conditions.

* For Discussion Purposes
## Performance Measures

### Temperature Dependent Mortality

<table>
<thead>
<tr>
<th>Tier</th>
<th>Frequency</th>
<th>Average</th>
<th>Range</th>
<th>Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tier 1</td>
<td>68%</td>
<td>6%</td>
<td>0.4 - 39%</td>
<td>&lt;15%</td>
</tr>
<tr>
<td>Tier 2</td>
<td>17%</td>
<td>15%</td>
<td>1 - 46%</td>
<td>&lt;31%</td>
</tr>
<tr>
<td>Tier 3</td>
<td>7%</td>
<td>34%</td>
<td>6 - 77%</td>
<td>&lt;65%</td>
</tr>
<tr>
<td>Tier 4</td>
<td>7%</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
</tbody>
</table>

### Egg to Fry Survival

<table>
<thead>
<tr>
<th>Tier</th>
<th>Frequency</th>
<th>Average</th>
<th>Range</th>
<th>Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tier 1</td>
<td>68%</td>
<td>29%</td>
<td>15 - 49%</td>
<td>32%</td>
</tr>
<tr>
<td>Tier 2</td>
<td>24%</td>
<td>21%</td>
<td>15 - 34%</td>
<td>27%</td>
</tr>
<tr>
<td>Tier 3</td>
<td>7%</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
</tbody>
</table>

If necessary, an independent panel will evaluate the conditions experienced during the years under review, the success of the implementation of the tiered strategy, the effect of the implementation on the species, and, if needed, develop recommendations to improve implementation and performance.
The Livingston Stone National Fish Hatchery, located at the foot of Shasta Dam near Redding, CA, raises winter-run Chinook salmon to supplement wild populations with measures that preserve genetic diversity.
Shasta Cold Water Pool Temperature Tiers

For Discussion Purposes

Target Temperature (°F)

May. 1  Jun. 1  Jul. 1  Aug. 1  Sep. 1  Oct. 1

Tier 1  Tier 2 Shape  Tier 3 Range  Tier 4  Example Strategy