

# Fall Chinook Salmon Site Specific Criteria

Idaho DEQ  
June 21, 2011

## Outline

- History
- SSC Proposal
- Overview of Fall Chinook salmon status
- Overview of Current Science Supporting SSC
- Regional comparison of fall Chinook salmon spawning
- Other life stage considerations
- Conclusion

## History

- 2006 – proposal for SSC to IDEQ; ODEQ participated as an Observer
- 2006 Proposal:
  - *Fall Chinook salmon criteria not greater than 16.5 C as a daily maximum temperature on October 23 and subsequent daily maximum temperatures not to exceed levels equal to 0.2 C daily rate of decline through Nov 10. From Nov 11 through April 15, the daily maximum temperature was not to exceed 13 C. Applied from HC Dam to the Oregon Washington Border (RM 176.1).*
- IDEQ held meeting to discuss Technical Merits -- overall consensus – the proposal was at “the edge of the envelope”

## 2010 – Idaho SSC Proposal

### Existing:

#### **286.SNAKE RIVER, SUBSECTION 130.01, HUC 17060101, UNIT S1, S2, AND S3; SITE-SPECIFIC CRITERIA FOR WATER TEMPERATURE.**

A maximum weekly maximum temperature of thirteen degrees C (13C) to protect fall chinook spawning and incubation applies from October 23rd through April 15th in the Snake River from Hell's Canyon Dam to the Salmon River.

### Proposed:

A maximum weekly maximum temperature of fourteen and an half degrees (14.5C) applies from October 23rd through October 31st and a maximum weekly maximum of thirteen degrees C (13C) applies from November 1st through April 15th to protect fall chinook spawning and incubation in the Snake River from Hell's Canyon Dam to the Salmon River.

## Idaho Definition

- Maximum Weekly Maximum Temperature
  - **Maximum Weekly Maximum Temperature** - the single highest weekly maximum temperature (WMT) that occurs during a given year or other period of interest, e.g., a spawning period. The WMT is the mean of daily maximum temperatures measured over a consecutive seven (7) day period ending on the day of calculation. When used seasonally, e.g., spawning periods, the first applicable WMT occurs on the seventh day into the time period. IDAPA 58.01.02.52.

Oct 23	Oct 24	Oct 25	Oct 26	Oct 27	Oct 28	Oct 29
→						14.5 C
Oct 30	Oct 31	Nov 1	Nov 2	Nov 3	Nov 4	Nov 5
→						
Nov 6	Nov 7	Nov 8	Nov 9	Nov10	Nov11	Nov12
→	13 C					

**MWMT**

<b>Oct 23</b> <b>16.0</b>	<b>Oct 24</b> <b>15.8</b>	<b>Oct 25</b> <b>15.5</b>	<b>Oct 26</b> <b>15.3</b>	<b>Oct 27</b> <b>15.0</b>	<b>Oct 28</b> <b>14.8</b>	<b>Oct 29</b> <b>14.5</b>
<b>Oct 30</b> <b>14.2</b>	<b>Oct 31</b> <b>14.0</b>	<b>Nov 1</b> <b>13.8</b>	<b>Nov 2</b> <b>13.6</b>	<b>Nov 3</b> <b>13.3</b>	<b>Nov 4</b> <b>12.9</b>	<b>Nov 5</b> <b>12.8</b>
<b>Nov 6</b> <b>12.8</b>	<b>Nov 7</b> <b>12.7</b>	<b>Nov 8</b> <b>12.6</b>	<b>Nov 9</b> <b>12.6</b>	<b>Nov10</b> <b>12.5</b>	<b>Nov11</b> <b>12.5</b>	<b>Nov12</b> <b>12.4</b>

Daily Maximums  
(2006 HC Dam - example)

<b>Oct 23</b>	<b>Oct 24</b>	<b>Oct 25</b>	<b>Oct 26</b>	<b>Oct 27</b>	<b>Oct 28</b>	<b>Oct 29</b> <b>15.3</b>
<b>Oct 30</b> <b>15.0</b>	<b>Oct 31</b> <b>14.8</b>	<b>Nov 1</b>	<b>Nov 2</b>	<b>Nov 3</b>	<b>Nov 4</b>	<b>Nov 5</b>
<b>Nov 6</b>	<b>Nov 7</b> <b>13.1</b>	<b>Nov 8</b> <b>13.0</b>	<b>Nov 9</b> <b>12.8</b>	<b>Nov10</b> <b>12.7</b>	<b>Nov11</b> <b>12.6</b>	<b>Nov12</b> <b>12.6</b>

Maximum Weekly Maximum

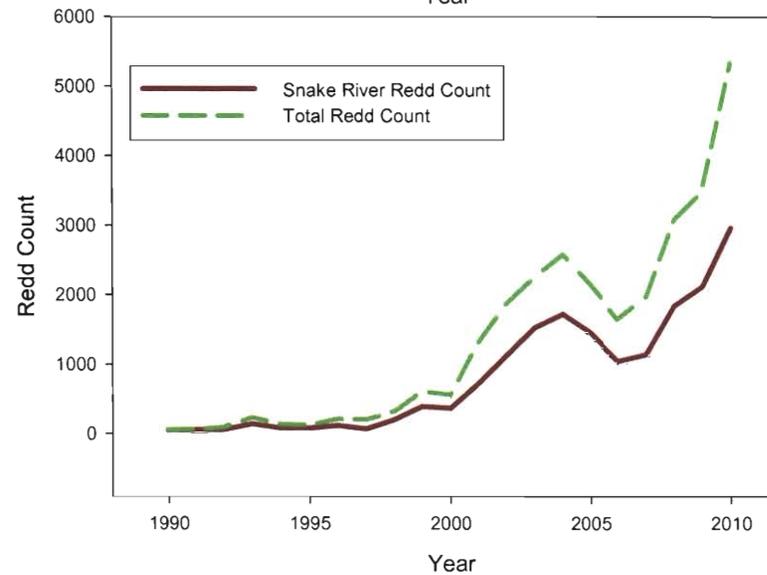
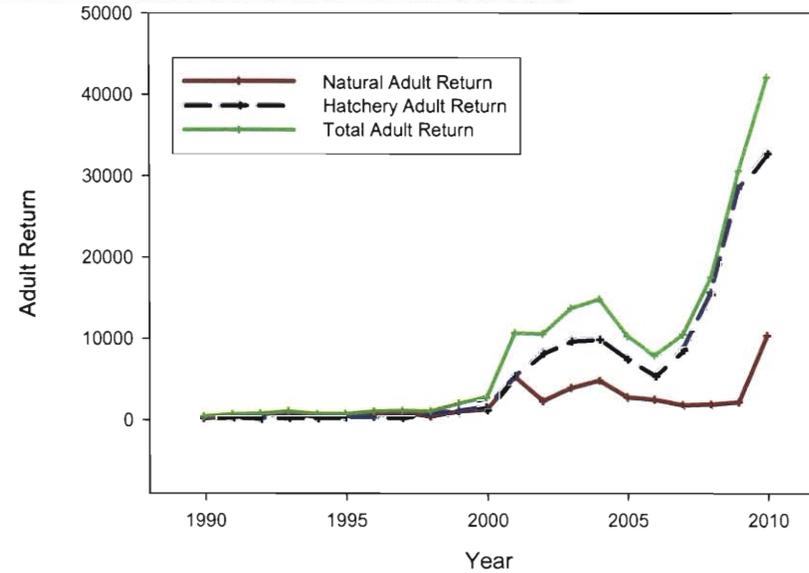
<b>Oct 23</b> <b>15.1</b>	<b>Oct 24</b> <b>14.9</b>	<b>Oct 25</b> <b>14.7</b>	<b>Oct 26</b> <b>14.5</b>	<b>Oct 27</b> <b>14.3</b>	<b>Oct 28</b> <b>14.1</b>	<b>Oct 29</b> <b>13.9</b>
<b>Oct 30</b> <b>13.7</b>	<b>Oct 31</b> <b>13.5</b>	<b>Nov 1</b> <b>13.3</b>	<b>Nov 2</b> <b>13.1</b>	<b>Nov 3</b> <b>12.9</b>	<b>Nov 4</b> <b>12.7</b>	<b>Nov 5</b> <b>12.5</b>
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Daily Maximums  
(proposal example –  
Assuming a 0.2 C daily rate  
of decline)

<b>Oct 23</b>	<b>Oct 24</b>	<b>Oct 25</b>	<b>Oct 26</b>	<b>Oct 27</b>	<b>Oct 28</b>	<b>Oct 29</b> <b>14.5</b>
<b>Oct 30</b> <b>14.3</b>	<b>Oct 31</b> <b>14.1</b>	<b>Nov 1</b>	<b>Nov 2</b>	<b>Nov 3</b>	<b>Nov 4</b>	<b>Nov 5</b>
<b>Nov 6</b>	<b>Nov 7</b> <b>12.7</b>	<b>Nov 8</b> <b>12.5</b>	<b>Nov 9</b> <b>12.3</b>	<b>Nov10</b> <b>12.1</b>	<b>Nov11</b> <b>11.9</b>	<b>Nov12</b> <b>11.7</b>

Maximum Weekly Maximum

# SR Fall Chinook salmon status

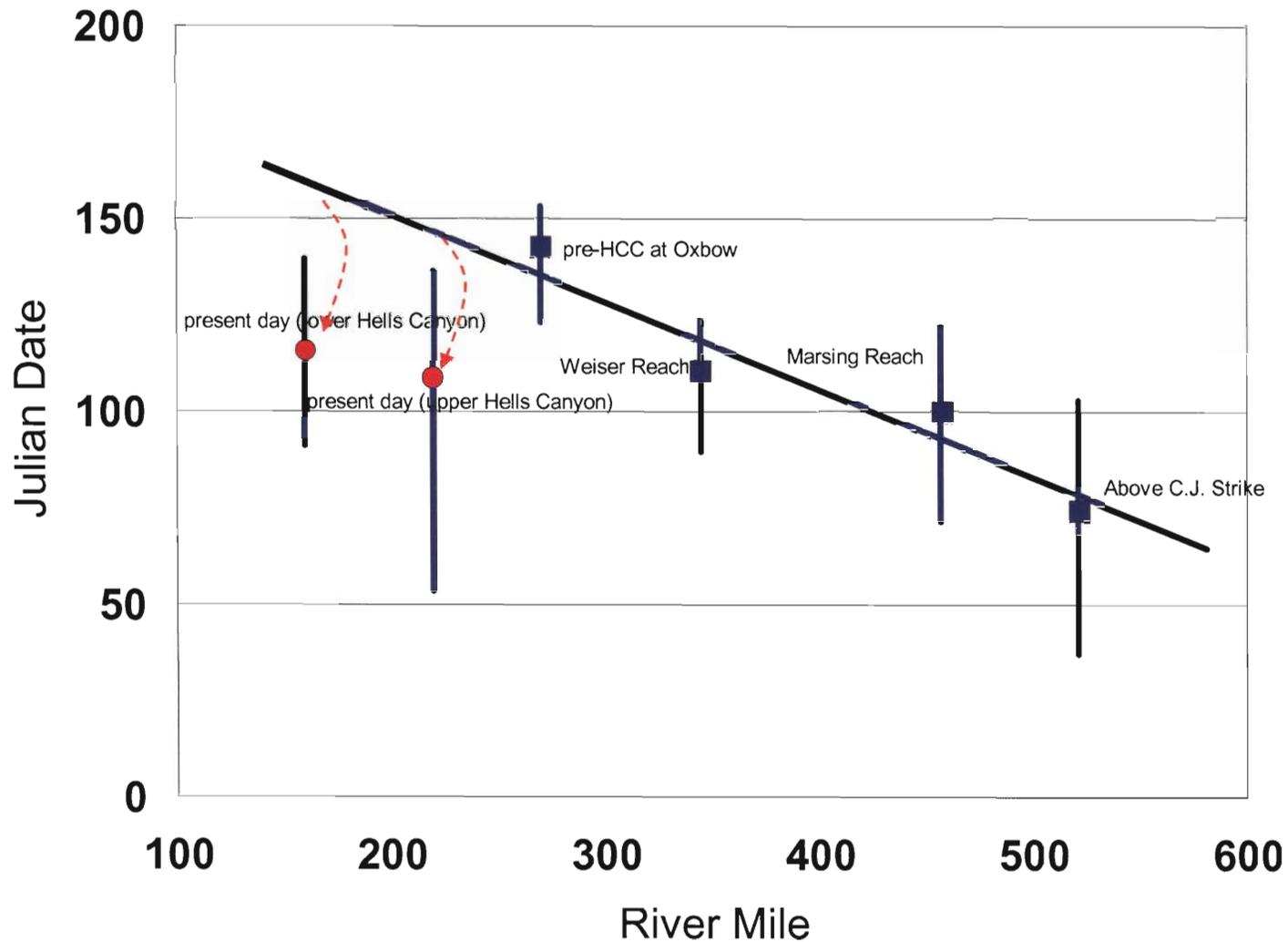


## SR - Fall Chinook salmon are Unique

- Fall chinook salmon spawn in periods of declining water temperatures
- Fall chinook salmon spawn in large mainstem environments / prone to warmer thermal regimes.
- Typical life history is Age-0 – rearing in fresh water for only a brief period
- These habitat and life history characteristics suggest that fall chinook salmon cannot be compared to other races of chinook salmon or other species of Pacific salmon
- Snake River fall chinook salmon juveniles demonstrate very high growth rate as juveniles
- There should not be “one-size fits all” temperature criteria.
- Fall chinook salmon require conditions that promote early emergence to maintain an Age-0 life history. Thermal conditions present below Hells Canyon today promote the Age-0 life history.

# Emergence Dates and Age-0 Life History

Emergence Dates



## Regional Comparisons

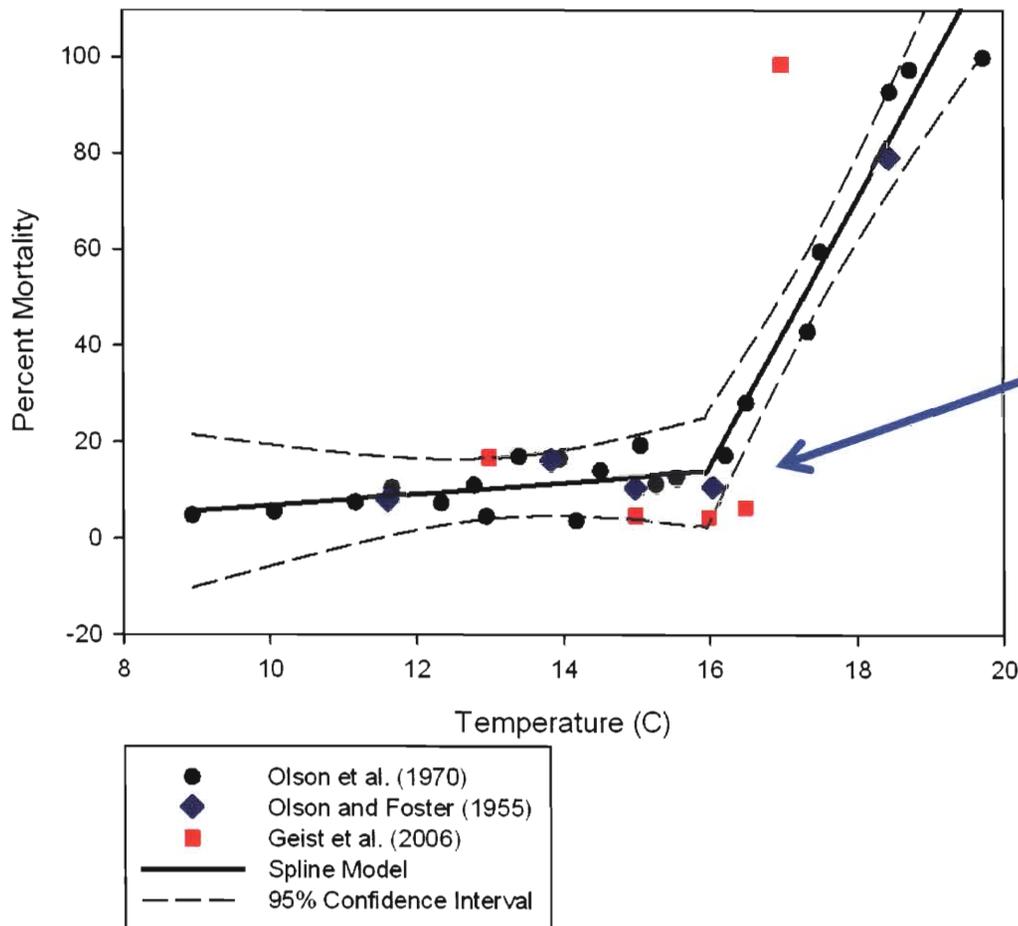
- Initial spawning at temperature  $\leq 16^{\circ}\text{C}$  is common for fall Chinook salmon, even in systems other than the Snake River (Hanford Reach, Lower Columbia River)
- 7-day Average Maximum Temperatures (on Oct 29<sup>th</sup>) for Hanford Reach v. Upper Hells Canyon and Lower Hells Canyon Reach

Year	Priest Rapids Tailrace	Hells Canyon Dam	RM 192.3	RM 165.7
2006	15.0	15.3	15	12.8
2008	14.3	14.9	14.8	12.6
2009	14.2	14.8	14.4	12.3

## Supporting Science

- Three specific studies to fall chinook salmon initial incubation temperatures:
  - Geist et al. (2006) – SR fall chinook salmon
  - Olson et al. (1970) – Hanford Reach fall chinook salmon
  - Olson and Foster (1955) – Hanford Reach fall chinook salmon
- All recognized a declining thermal regime
- All three studies indicated a sharp increase in mortality when a threshold temperature during incubation was exceeded.
  - Geist et al. (2006) reported a temperature threshold value of 16.5°C
  - Olson and Foster (1955) study reported a value of 16.1°C
  - Olson et al. (1970) did not report a threshold value, but yielded a temperature threshold for mortality similar to that found in the Olson and Foster (1955) report.

# Supporting Science



- Segmented regression – a spline model.

- “join point” – indicates threshold temperature at which mortality begins to increase.

- threshold value – 16°C

- 95% confidence interval ranging from initial daily maximum of 15.3°C to 16.6°C.

- An initial daily maximum of 15.3°C under a 0.2 °C daily rate of decline is equal to a 7-day average temperature of 14.7 °C.

## Other Life Stage Considerations

- IPC is not proposing to change existing standards on the pre-spawn environment – the proposal affects only the salmonid spawning period
  - No differences observed in the adult migration period
  - No apparent shift in spawn timing
  - No evidence of high pre-spawn mortality
  - No evidence of pre-spawn reduced gamete viability

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## Conclusions

The weight of evidence strongly supports a conclusion that IPC's proposed SSC of a maximum weekly maximum temperature of 14.5 °C from Oct 23 and 13 °C from November 1 provides complete protection for fall Chinook salmon spawning and incubation.

## Scientific Peer Reviews

The well-prepared and documented proposal is clearly based on the best scientific information available in the peer-reviewed, published literature as well as relevant agency documents. On the basis of this information, it is my conclusion that the proposed site-specific standard of a weekly average of maximum daily temperatures of 14.5°C between October 23 and 31 will be protective of egg incubation for the fall Chinook salmon population in the Hells Canyon reach.

Sincerely,



Charles C. Coutant, Ph.D.

When coupled with information specific to the Hells Canyon Reach of the Snake River, it is clear that IPC had compiled and reviewed all of what I would consider the major keystone pieces of information related to salmonid temperature requirements and that the amount of literature was more than sufficient for developing the proposed site specific criteria. Thus, my first conclusion related to the proposal is that the information and data assembled were appropriate and sufficient for developing the site specific criteria proposal.

... it is my opinion that the proposed SSC would be protective of fall Chinook salmon spawning, egg incubation, and fry emergence.



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