

# NFS

NATIVE FISH SOCIETY

Conserving biological diversity of native fish and protecting their habitats

May 3, 2006

## MEMORANDUM

**TO: ODFW Commission**  
**FR: Bill Bakke, Director**  
**RE: Columbia River Thermal Refuges for Salmon and Steelhead**

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I am once again raising the issue of protection of migrating salmonids in the Columbia River during the summer months when water temperatures exceed optimal conditions for salmon and steelhead, forcing them to use thermal refuges available along the migration route.

I have presented information to the Commission on this issue in the past and to the ODFW staff. On June 9, 1999 I recommended that the mouth of Herman Creek be closed to harvest but I was told by ODFW staff that this fishery was well regulated. On June 8, 2005 I again provided ODFW and NMFS with information important to salmon and steelhead conservation related to thermal refuges, but received no response.

A study of fall chinook and summer steelhead migration patterns and the value of thermal refuges has been published in the Transactions of the American Fisheries Society in 2006 and I have provided some information from these studies below and attached the papers to this memo. My purpose is for the Commission to address this problem in two ways (1) to adjust harvest management to protect migrating steelhead and chinook that are using thermal refugia in the Columbia River, and (2) secure watershed conditions and flows in streams contributing to thermal refugia in the Columbia.

**Behavioral Thermoregulation and Slowed Migration by Adult Fall Chinook Salmon in Response to High Columbia River Water Temperatures. Trans. Amer. Fish. Soc. 2006**

"This historical data showed significant shifts in fall chinook salmon run timing distributions concomitant with Columbia River warming and consistent with increasing use of thermal refugia. Coolwater tributaries appear to represent

critical habitat areas in warm years and we recommend that both main-stem thermal characteristics and areas of refuge be considered when establishing regulations to protect summer and fall migrants.”

“Over the last several decades, the main stem has steadily warmed earlier in the spring and cooled later in the fall. Warming due to impoundment and water diversion has been exacerbated by regional climate change. Since 1948, air temperatures have increased significantly (> 1 degree C) in much of the Pacific Northwest. Recent August and September water temperatures in the Columbia River have averaged 20-21.5 degrees C, with maximum daily highs of up to 24 degrees C. Optimum temperatures for migrating adult chinook salmon are thought to be between 10.5 and 19.5 degrees C. The incipient lethal limit for jack fall chinook salmon is 21-22 degrees C and the critical thermal maximum for the species is 25 degrees C.”

“Columbia River water temperatures were greater than 20C and as high as 23 C through most of August in all years then steadily cooled through September and October. Mean daily tributary temperatures were approximately 2 degrees to 7 degrees C cooler than the main-stem Columbia River during both August and September. One behavior of particular interest was the temporary use (12 hours to 34 days) of coolwater tributaries by migrants destined for upstream spawning areas.”

The study notes that important thermal refugia identified in the study are: **Eagle Creek, Herman Creek, Wind, Little White Salmon, White Salmon, Deschutes, Klickitat rivers.** These refugia are found in Bonneville and the Dalles pools and in the states of Oregon and Washington. However, the authors of this study said that not all potential refuge areas were identified or sampled.

“The proportions of salmon that used tributaries increased exponentially with increasing mean weekly Columbia River water temperature, from mostly less than 5% when temperatures were below 20C to about 40% when temperatures neared 22C. The likelihood of temporary tributary use increased significantly as Columbia River temperature increased. The results also suggest an apparent threshold temperature for Columbia River fall chinook salmon between 20C and 21C (68 to 71.6 degrees F), above which many fish seek refugia or reduce migration activity.”

“...fall chinook salmon have a relatively short window in which to migrate prior to the onset of spawning at upstream areas. The imperative of reaching spawning grounds at appropriate times may have prompted adult salmon to continue migration even when temperature conditions were suboptimal. This behavior contrasts with that from similar analyses for adult steelhead where we

found stronger relationships between temperature, passage rates, and the proportion of radio tagged fish that temporarily entered lower river tributaries.”

“..exposure to high temperatures during migration has been associated with elevated bioenergetic depletion and prespawn mortality.”

“...attention should be focused on maintaining favorable thermal conditions and refugia within these rivers. During the warmest periods, large numbers of salmon can be expected to concentrate in tributary streams where they may be exposed to terminal fisheries. This may be especially relevant for Snake River fall chinook salmon, which are listed as threatened under the Endangered Species Act and for which reduced survival in the migration corridor could have significant population-level impacts.”

The predicted rise in global temperature from 2C to 5C over the next century, combined with warming due to impoundment and water diversion suggests Columbia River temperatures will continue to rise. It is possible this trend may be tempered through managing the system to more closely mimic natural flow patterns. However, the ability of fall chinook salmon and other migratory stocks to adjust to increasing temperatures may determine their ability to persist in the Columbia River and elsewhere.”

#### **Temporary Staging of Columbia River Summer Steelhead in Coolwater Areas and Its Effect on Migration Rates. Trans. Amer. Fish. Soc. 2006**

“By monitoring the movement patterns of 2,900 individual steelhead over 3 years (1996, 1997, and 2000), we determined that an average of 61% of the steelhead destined for upstream areas temporarily staged in one or more tributaries in the lower Columbia River for durations from less than 1 hour to 237 days. Our results highlight the need to preserve the water quality parameters of existing cooler-water Columbia River tributaries and to rehabilitate watersheds that historically maintained cooler-water tributaries as sources of thermal refugia for adult summer steelhead returning to the basin. “

“The National Marine Fisheries Service has identified five steelhead evolutionarily significant units in the Columbia River basin, and all five ESUs are currently protected under the Endangered Species Act.”

“Conversion of the once free-flowing Columbia River into a series of reservoirs by means of dam construction and river flow attenuation has significantly altered the river environment. Currently, the Columbia River water temperatures reach higher maximums and remain warm longer into the fall relative to the period prior to most of the dams’ construction.”

“Concerns of managers leading recovery efforts include (1) the time required for returning adults to navigate through the migration corridor and (2) the effect of summer water temperatures that often exceed upper incipient lethal levels.”

Seven tributary rivers enter the Columbia River in Bonneville Reservoir: three from the Oregon (south) shore (**Eagle Creek, Herman Creek, and Hood River**) and four from the Washington (north) shore (**Wind, Little White Salmon, White Salmon, and Klickitat rivers** and the **Deschutes River** entering The Dalles Reservoir. Combined, the three largest tributaries (White Salmon, Klickitat, and Deschutes rivers ) contributed 6% of the total Columbia River flow during the summers of 1996, 1997, and 2000.”

“In all years, the majority of migrating steelhead – from 57% to 66% of the radio tagged fish that migrated upstream of the Dalles Dam – temporarily staged in at least one downstream tributary. Tributary use was highest in 2000 and lowest in 1996, when water temperatures were close to average. “

“Two tributary rivers (Little White Salmon and Deschutes) were used preferentially over others available during the 3 years studied. Approximately 25% to 30% of the tagged steelhead that migrated upstream of the Dalles Dam were observed in at least one of these two rivers, and these two tributaries accounted for 78% to 83% of all tributary usage.”

“Residence times of radio-tagged steelhead in the Little White Salmon River were greater than those of steelhead in other tributaries in all significant pairwise comparisons.”

“The Deschutes River may also be more attractive to steelhead because it is the only coolwater refuge in the Dalles Reservoir, which is warmer than Bonneville Reservoir. In 2000, water temperatures at the Dalles Dam averaged nearly 1 degree C warmer than those at Bonneville Dam during June-October. “

“We found no evidence of higher proportions of A-run than B-run steelhead utilizing coolwater tributaries.”

“This study demonstrated the need for the conservation of lower Columbia River tributary habitat to ensure the availability of coolwater refugia to listed runs of upriver adult steelhead migrants. The need may be more urgent in the future, as average air temperatures are expected to continue to increase in light of predicted regional climate change.”

“Agencies responsible for setting fishing regulations should be mindful that decisions affecting harvest in downstream tributary areas may potentially affect listed upriver stocks. In warmer years, such effects are potentially greater.”

“...wise management of Columbia River sport and commercial fisheries in and near coolwater tributaries may prove increasingly necessary to sustain and recover wild populations of summer steelhead in the Columbia River basin.”

## **Conclusion**

Since 1999 the Native Fish Society has requested that the Commission and ODFW staff evaluate the effect of fisheries in thermal refugia. In light of these two studies, we repeat that request and encourage the Commission to coordinate this evaluation with Washington Department of Fish and Wildlife in an effort to establish coolwater refugia for ESA listed salmonids and those considered healthy enough to not be listed at this time (e.g. Deschutes River fall chinook). It is our expectation that these thermal refugia would become established sanctuary areas for migrating adult salmonids and that the states establish a tributary watershed and water flow priority to secure these coolwater thermal refugia in the Columbia River. Growing concern about increasing temperatures in the Columbia River and the prediction of rising temperatures due to global warming, should make this a management priority.