



MEMORANDUM

TO: TRRP FALL FLOWS SUBGROUP
FROM: TIM HAYDEN, FLOW SCHEDULE WORKGROUP COORDINATOR
SUBJECT: 2010 AND 2011 FALL FLOW RELEASE CRITERIA AND EVALUATION PROCESS
CC: TRRP FLOW WORKGROUP MEMBERS
 ERNEST CLARKE, TRRP SCIENCE COORDINATOR
 ROBIN SCHROCK, TRRP EXECUTIVE DIRECTOR
DATE: MARCH 20, 2012

In 2010 the TRRP staff, TRRP partners and KBAO jointly developed Proactive and Emergency fall flow release criteria which were designed to avert a fish disease outbreak and subsequent fish kill, such as the kill that occurred in 2002.

During WY 2011/2012, the Fall Flows Technical Subgroup evaluated conditions utilizing the 2010 fall flow release criteria/triggers to determine the need for a proactive fall flow release.

Based on river forecast models and run-size projections during the late-summer/fall of 2011, the Fall Flows Technical Subgroup recommended that neither a Proactive or Emergency Fall Flows release were warranted to prevent the outbreak of *Ichthyophthirius multifiliis* (Ich) and/or *Flavobacterium columnare* (Columnaris) to avert a Klamath/Trinity fall-run Chinook salmon disease outbreak (TMC Memo 2010). The 2010/2011 physical and biological criteria and recommended management actions are summarized below:

Proactive Fall Flow Release Criteria (Table 1):

1. Flows projected above 2,800 cfs at Klamath River RKM 13 during the adult fall-run Chinook salmon migration season = no recommendation for a Proactive fall flow release (Strange 2010) ;
2. Flows projected below 2,800 cfs at Klamath River RKM 13 during the migration season and projected fall Chinook salmon run-size at or above 170,000 adult and jacks (estimated run size during the 2002 fish kill year) = recommend implement Proactive fall flow release to increase base flows to 2,800 cfs during primary fall Chinook salmon migration season (3rd week August-Sept 30) (Strange 2010);

3. Flows projected below 2,500 cfs at RKM 13 during the migration season = recommend implement Proactive fall flow release to increase base flows to at least 2,500 cfs during migration season regardless of projected fall Chinook salmon run-size (Turek et al. 2004) .

Table 1. Summary of Proactive Fall Flows release criteria and Linked Recommended Management Actions.

Proactive Criteria	Management Action
Flows projected above 2,800 cfs at Klamath River (RKM 13) during the adult fall-run Chinook salmon migration season (3 rd week August-Sept 30)	Recommend No Proactive Fall Flow release
Flows projected below 2,800 cfs at Klamath River (RKM 13) during the migration season and projected fall Chinook salmon run-size at or above 170,000 fish	Recommend Implement Proactive Fall Flow release to increase base flows to 2,800 cfs during primary fall Chinook salmon migration season (3 rd week August-Sept 30)
Flows projected below 2,500 cfs at Klamath River (RKM 13) during the migration season	Recommend Implement Proactive Fall Flow release to increase base flows to at least 2,500 cfs at Klamath River RKM 13 during the migration season regardless of projected fall Chinook salmon run-size.

Emergency Fall Flow Release Criteria (Table 2.)

An emergency release is designed to decrease the severity of a disease outbreak if real-time monitoring indicates an increase in the incidence of Ich infections of fall-run Chinook salmon. The recommendation for an Emergency Fall Flow release is conditional upon two-stage criteria, including:

1. No Proactive Fall Flow release is planned, and;
2. Multiple severe confirmed Ich infections are observed and confirmed = recommendation to implement immediate Emergency Fall Flow release with a 7 day duration pulsed spike to **double pre-existing base flows** in the lower Klamath River (RKM 13) at the time of Ich infections, followed by a bench release to increase base flows to the minimum recommended level of 2,500 or 2,800 cfs, depending on run-size for the remainder of the migration season (Strange 2010).

A single observed incidence of Ich would lead to greater monitoring and evaluation effort, including confirmation by fish disease experts. If multiple severe infections are documented and confirmed, an emergency release would be recommended. The duration of the 7 day (total duration with ramping) peaked flow release is determined by the life cycle of Ich, which takes 7 days to complete at 20°C (Dickerson and Dawe 1995). No Ich infections have been documented in annual monitoring since the 2002 fish kill, with the exception of a few infected fall-run Chinook salmon in 2003, thus any documented Ich infections are very significant and may indicate an impending disease outbreak (Strange 2010).

Table 2. Summary of Emergency Fall Flow Release Criteria and Linked Management Action.

Emergency Criteria	Management Action
1. No Proactive Fall Flow release is planned	
<i>AND</i>	
2. A single incidence of Ich is observed	Increase amount and intensity of Ich disease monitoring
3. Multiple severe confirmed Ich infections are observed	Recommend implement immediate Emergency Fall Flow release with a 7 day duration pulsed spike to <i>double pre-existing base flows</i> at the time of Ich infections, followed by a bench release to increase base flows to the minimum recommended level of 2,500 or 2,800 cfs for the remainder of the migration season.

TRRP Fall Flows Subgroup Criteria Evaluations: 2011 River Flow and Run-size Projections

In 2011, the Fall Flows Subgroup Coordinator, Tim Hayden worked with members of the subgroup to conduct bi-weekly evaluations of both the Proactive and Emergency Fall Flow release criteria to determine if recommendation of a Proactive and/or Emergency fall flow release was warranted. The Fall Flows Subgroup utilized the following river flow forecasting and fall-run Chinook salmon run size estimation methods to evaluate the previously described Proactive and Emergency Criteria;

Lower Klamath River Flows Forecast

The TRRP Fall Flows Subgroup conducted bi-weekly estimates of lower Klamath River flows at RKM 13 for the period from August 1 through September 30 by summing:

1. The National Weather Service Advanced Hydrologic Prediction Services prediction for lower Klamath River flows excluding reservoir releases
2. Estimated Iron Gate flow releases using the Variable Flow Release Procedure as described in the 2011 Klamath River Operations Plan
3. 2011 TRRP summer base-flow releases from Lewiston Dam.

2011 Fall Chinook Salmon Run-size Projections

The ocean escapement of Klamath Basin fall Chinook salmon in 2011 was projected at 102,000 adult fish (Klamath Ocean Harvest Model, 12 April 2011, STT-PFMC). In addition to the adult escapement, the expected age-2 (jack) return is estimated by assuming the inter-annual proportion of jacks relative to the total run from 1978 through 2010. In 2010, Bureau staff and TRRP partners concluded that variability in the jack proportion was high when considering all years of record. However, in years of moderate to high adult run sizes ($\geq 100,000$), the post-season estimated jack proportion was much less variable and somewhat stable at larger run sizes (Polos, Memorandum to Fall Flow Augmentation Ad Hoc Group, 29 June 2010).

Given the moderately high projected adult ocean escapement in 2011, an expected proportion of jacks based on the average historic observations during moderate to high run size years is 0.076.

Hence, Total 2010 Klamath Basin Fall Chinook Salmon Run Size was estimated as:

$$\text{(Adult Forecast)/(1-jack proportion),}$$

Or

$$(102,000)/(1-0.076) = 110,390$$

Additional 2011 Fall Flows Subgroup Recommendations

The Fall Flows Subgroup also developed several recommendations regarding the role of the subgroup, future evaluation of criteria and the need and purpose for Fall Flow Implementation Plan to support technical evaluations and management recommendations. These recommendations include:

1. The Fall Flows Subgroup is technical and advisory; and does not make policy recommendations. Implementation would be dependent upon source of water, release schedules from IGD and/or Lewiston Dam, and environmental permitting issues. The sub-group recommends to the TRRP Flow Workgroup that a broader interagency group address comprehensive monitoring strategies and data gaps.
2. Future evaluation of criteria should be conducted regularly (bi-weekly) by the Fall Flows Subgroup with broad-based participation by technical representatives from all TRRP Partner agencies.
3. Evaluations of flow and temperature each summer and fall should commence in July and continue bi-weekly through the end of September. All Fall sub Work group members should be given the results of the evaluations and be ready to meet as the season progresses. If the flow predictions appear to indicate declining flows in the lower Klamath, or evidence of ich, a larger meeting should be called to make recommendations.
4. The Fall Flows Sub-group attempted to develop a draft purpose statement for the Fall Flows Implementation Plan. Core to the Fall Flows subgroup is to understand the evolution of fall flow release criteria and recognizing that the realities and impacts of the 2002 fish die off to the fishery resources of the Klamath and Trinity rivers and the dependent fisheries, which is the impetus for fall flow releases.

The purpose of the annual Fall Flows Implementation Plan is to define the technical evaluations needed, data gaps, identification of the proposed total water volume recommended, potential water sources, release schedules from Iron Gate Dam and/or Lewiston Dam, and the timing and duration of the releases (considering travel time from the dams to the Lower Klamath River) required to implement a Proactive/Preventative and/or Emergency fall reservoir release(s) from the Iron Gate or Lewiston Dams for the purposes of minimizing or averting chronic and acute effects of disease pathogens on adult Klamath/Trinity fall run Chinook salmon in the Lower Klamath River. The Fall Flows Subgroup provides technical evaluation into this process, including; river flow forecasts/modeling, run-size forecasts, and evaluation of the need to recommend Proactive and Emergency flow using the release criteria. The Fall Flows Subgroup will also recommend biological and physical assessments for the purposes of refining our ability to predict the need for a fall flow. Knowledge gaps will be identified and prioritized.

References

Dickerson, H. W., and D. I. Dawe. 1995. *Ichthyophthirius multifiliis* and *Cryptocaryon irritans* (Phylum Ciliophora). Pages 181-227 in P. T. K. Woo, editor. Fish Diseases and Disorders: Protozoan and Metazoan Infections, volume 1. CABI, New York, New York.

Strange, J.S., 2010. Summary of scientific evidence to guide special flow releases to reduce the risk of adult fall Chinook salmon mass disease mortality in the lower Klamath River. TRRP. 17 pp.

Turek, S., Rode, M., Cox, B., Heise, G., Sinnen, W., Reese, C., Borok, S., Hampton, M., and Chun, C. 2004. September 2002 Klamath River Fish-Kill: Final Analysis of Contributing Factors and Impacts. California Department of Fish and Game. 183pp.

