State of California

Memorandum

To: Mr. Howard Kolb
Central Coast Region
California Regional Water Quality Control Board
895 Aerovista Place, Suite 101
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Date: May 16, 2005

From : Robert W. Floerke, Regional Manager
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Subject: General Conditional Waiver of Waste Discharge Requirements - Timber Harvest Activities in the Central Coast Region (Resolution No R3-2005-0066) SCH 2005041068

In 1993, the Board of Forestry established the Monitoring Study Group (MSG) towards the implementation of a long-term program for monitoring the effects of timber operations on the quality and beneficial uses of water. In 1997, the Department of Fish and Game (DFG) produced the Instream Monitoring Handbook (CDFG 1997) to assist in the development and implementation of instream monitoring programs and conducting biological assessment of instream habitat. DFG recommends review of this document during consideration of monitoring strategies for timber harvesting plans.

Recovery of Coho Salmon

In February 2004, the Fish and Game Commission approved DFG's "Recovery Strategy for California Coho Salmon" (CDFG 2004). Coho salmon are State-listed as endangered in the California Central Coast Coho Evolutionarily Significant Unit (CCC Coho ESU), which includes the San Mateo and Big Basin hydrologic units. These two basins constitute the southern extent of coho salmon in the eastern Pacific Ocean, and are critical to recovery of the CCC Coho ESU. Per California Fish and Game Code § 2055, it is the policy of the State that all State agencies, boards, and commissions shall seek to conserve endangered species and shall utilize their authority in furtherance of the purposes of the California Endangered Species Act. DFG proposes that any timber harvest waiver take into consideration both the watershed-specific and appropriate range-wide recovery recommendations presented in the recovery strategy. DFG also recommends that any Board permitting both be consistent with incidental-take permitting under the California Endangered Species Act and have the potential to further the goals of the recovery strategy.

DFG's coho salmon recovery program is available to confer with the Board on coho salmon recovery, and you may contact Mr. Kevin Shaffer at (916) 327-0713, or by email at kshaffer@dfg.ca.gov, to discuss further such coordination.

Water Quality Objectives for Cold Freshwater Habitat and the Effects of Elevated Temperatures on Coho Salmon and Steelhead

The staff report includes consideration of water temperature and prescribes monitoring. By reference to the water quality objectives of the1994 Basin Plan, an impact to water temperature is defined as an increase in more than 5° F above the natural receiving water temperature. The staff report also suggests 68° F as an upper limit of suitable temperatures. In watersheds that provide habitat for coho salmon and steelhead, we believe that the public interest would benefit from modification of these objectives to conform to what is known about the thermal tolerances of coho salmon and steelhead. Given the state policy to enhance conditions for endangered species, we believe that in watersheds where coho salmon are present or planned for recovery, regulatory thresholds for water temperatures should be keyed to providing optimal conditions during the most sensitive life stages.

The effect of elevated water temperatures on salmonids is a complex topic area. Reactions to stressing temperatures vary with life stage, acclimatization, duration of exposure, food supply, and other factors. We recommend that staff review recent scientific literature in this topic area. "An Analysis of the Effects of Temperature on Salmonids of the Pacific Northwest with Implications for Selecting Temperature Criteria" (Sullivan and others 2000) provides an excellent review of the topic including a literature review, an evaluation of existing regulatory criteria, and reports of the authors' findings regarding acute exposure thresholds and quantification of growth effects of chronic exposure.

We foresee difficulties with implementation of the specified objectives. It is unclear how the "natural receiving water temperature" would be determined. There are a number of different metrics used for characterizing instream temperatures. Which metrics may be applied to evaluate a potential 5° F increase is not specified.

The Recovery Plan for coho salmon describes the suitable ranges of instream temperatures for different life stages (see Table 1).

	Suitable Range (°F)	*Reference or Citation*
migrating adult	44.6 - 59	(Reiser and Bjornn 1979)
spawning adult	39.2-48.2	(Bjornn and Reiser 1991)
rearing juvenile	35 (lower lethal) 78.8-83.8 (upper lethal) 53.6-57.2 (optimum) 48-59.9 (optimum) 63.7-64.9 (MWAT[f]) 62.1(MWAT) and 64.4 (MWMT[g])	(Bjornn and Reiser 1991) (Flosi and others 1998) (Ambrose and Hines 1997; Ambrose and Hines 1998) (Hines and Ambrose ND) (Welsh and others 2001)
eggs and fry	39.2-51.8 39.2-55.4 (optimum) 32-62.6	(Davidson and Hutchinson 1938) (Bjornn and Reiser 1991) (PFMC 1999)

Table 1. Suitable temperature ranges for coho salmon from the Recovery Strategy for California Coho Salmon (CDFG 2004). [f] MWAT = Maximum weekly average temperature. [g] MWMT = Maximum weekly maximum temperature.

Sullivan and others (2000) developed a risk-based approach to the effects of acute exposure of summertime temperatures on juvenile salmonids. Specifically, they analyzed existing experimental data sets to produce estimates of temperature vs. time of exposure curves where 10% mortality of the subject populations would be expressed (see Figure 1). It is worthwhile to note that a change in 5° F dramatically decreases the time of exposure necessary to effect 10% mortality. The authors suggest an annual maximum temperature threshold of 26° C (78.8° F) to prevent mortality of salmon in natural rivers and streams and recommend site-specific analysis for streams where annual maximum temperature is between 24° C (75.2° F). These findings are based on data from streams in the Pacific Northwest region. It may be appropriate to conduct further analysis for the central California Coast.

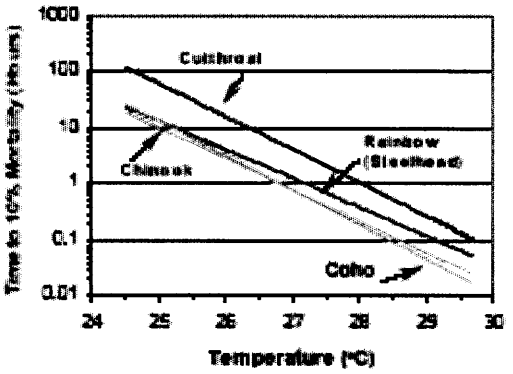

Figure 1. Duration curve for the LT10 acute effects of temperature for pacific salmonids acclimated at 15 C, taken from Sullivan and others (2000)

The growth rate of juvenile salmonids in freshwater habitats is an important factor in the success of individuals in marine environments and for the productivity of the population. Growth rates of juvenile salmonids can be expressed as a function of temperature and food ratio (see Figure 2). Juveniles achieve the greatest growth rates when summer water temperatures are close to optimal. At low levels of food consumption growth rates are low, but are improved at cooler temperatures. Sullivan and others (2000) developed a bio-energetics based approach for evaluating the effects of chronic exposure to elevated temperature on the growth of juvenile salmonids. They determined 7-day maximum temperature thresholds necessary to avoid growth rate reductions greater than 10% of optimal. These thresholds were 13 - 16.5°C (55.4 - 61.7°F) for coho salmon and 14.5- 21°C (58.1 - 69.8°F) for steelhead. Coho were found to be more sensitive to temperature and the authors suggest that thresholds for coho should be applied when these species co-occur.

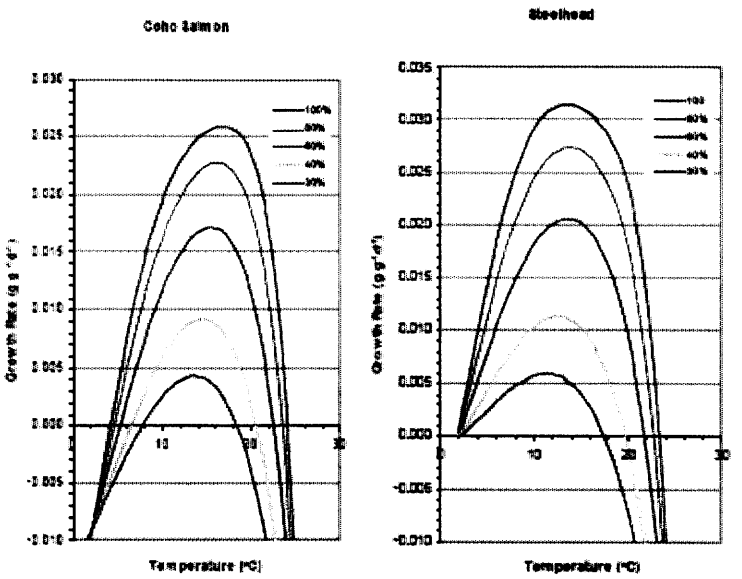

Figure 2. Specific growth rate curves for coho salmon and steelhead at 1 gram weight, taken from Sullivan and others (2000). Each line is the ration expressed in % satiation.

Beschta and others (1987) report lower temperature thresholds for coho and steelhead (see Table 1).

				Juvenile Rearing		
Species	Upstream Migration (°F)	Spawning (°F)	Incubation (°F)	Preferred (°F)	Optimum (°F)	Upper Lethal (°F)
Coho	45.0-60.1	39.9-48.9	39.9-55.9	53.2-58.3	---	78.4
Steelhead	---	39.0-48.9	---	45.1-58.3	50.0	75.4

Table 1. Water temperature criteria for coho salmon and steelhead. Taken from Beschta and others (1987).

Our experience in the Central Coast is that coho are rarely, if ever, found in waters where the temperature exceeds optimum conditions.

DFG recommends that in watersheds which provide habitat or recovery potential for coho salmon and steelhead, any instantaneous temperatures in excess of 78.8°F is considered an impact.

DFG recommends that in watersheds which provide habitat or recovery potential for coho salmon, a measurable increase from pre-project condition in maximum weekly maximum temperature which exceeds the optimal range for rearing juvenile coho salmon is considered an impact.

DFG recommends that in watersheds which provide habitat or recovery potential for steelhead, but not for coho salmon, a measurable increase from pre-project condition in maximum weekly maximum temperature which exceeds the optimal range for steelhead is considered an impact.

Eligibility Criteria Decision Tool

The waiver includes an Eligibility Criteria Decision Tool that produces a numeric score for determining the monitoring requirements of the THP. The components of the Decision Tool are the Cumulative Effects Ratio, the Drainage Density Index, and the Soil Disturbance Factor.

Cumulative Effects Ratio

The Cumulative Effect Ratio is a numeric score reflecting the ratio of acres harvested in the last 10 years (including the acres proposed for harvest) to the total acreage of the planning watershed.

Overall, the application of the Cumulative Effects Ratio appears to have the intent of increasing the intensity of monitoring with the level of cumulative impacts. Such an approach may not be appropriate, as it would tend to decrease the protection of streams which are in good or restorable condition. The California Salmonid Stream Habitat Restoration Manual (Chapter X - "Upslope Assessment and Restoration Practices" - in Flosi and others 1998) reflects our view of prioritization of waters for resource protection and restoration, in which the highest priority is given to waters which are in good or restorable condition.

DFG does not dispute that rate of harvest may be an important factor in predicting the effects of timber harvesting on aquatic habitat condition. However, the basis for the 10-year time-frame is unclear to us. Our experiences in evaluating the impacts of timber harvesting and observations made on working timberlands suggest that, depending on practices and other factors, impacts to aquatic habitat from harvesting may persist substantially longer than 10 years.

We have not run trial analysis, but we are concerned that the utilization of the Calwater planning watershed as the ratio denominator may produce results which are more reflective of the administrative aggregations of watershed units rather than the intensity of management activities.

Impacts from harvesting are expected to vary, in part, with the extent to which protective standards are applied within the THP. The metric as proposed would not credit forest managers who have successfully implemented higher protective standards in the past. Additionally, in some mixed-use watersheds, timber harvesting is not expected to be the sole source of adverse inputs to aquatic habitat.

DFG recommends that the Cumulative Effects Ratio be modified to incorporate: 1) prioritization based on the presence of sensitive receptors in receiving waters on and downstream of the project site, 2) reflects the current condition of aquatic habitat in downstream and receiving waters, and 3) similar to the proposed application of the 303(d) listing criteria, automatic rating of "high" when the project is within a watershed currently or historically occupied by coho salmon and steelhead and current stream conditions do not provide optimal habitat conditions.

The California Stream Bioassessment Procedure (Harrington and Born 2000) includes a repeatable method for evaluating physical conditions of habitat quality which produces a numeric score and may be useful for this purpose in its current or modified form.

Drainage Density Index

The Drainage Density Index (DDI) component of the Decision Tool is the weighted sum of length of watercourse within the plan area divided by the area of the harvesting plan. The staff report recognizes the relationship between DDI and rainfall, slope, and geologic conditions. However, it appears to us that the proposed stream class weighting factors will result in shifting away from steep areas which tend to have only class III watercourses and towards flatter areas which tend to have class I watercourses. We believe that it would be more appropriate to drop the stream classification weighting factors and appropriately adjust the "high" threshold value such that the most sensitive sites are rated as "high" for this criterion.

DFG recommends that the stream classification weights are dropped from the DDI. It may be appropriate to make a downward adjustment of the "high" threshold of 100 if the weighting factors are eliminated from the DDI.

Class IV watercourses are artificial channels which include inboard ditches and other features which have a high potential to deliver fine sediments to natural watercourses. It would be worthwhile to consider including in the DDI class IV channels which deliver flow to natural watercourses.

Monitoring

The staff report states that part of the objectives of the monitoring requirements is to collect data to support adaptive changes to the waiver conditions. However, water quality measurements are prescribed only for Tier III harvesting plans. Water quality measurements are critical for establishing relationships between management activities to water quality (DFG 1997). We anticipate that the inclusion of water quality measurements for the high-risk group only would bias the results and subsequent adaptive management adjustments. In addition, water quality measurements may be beneficial in detecting inputs

that may escape detection by visual and photo-point methods and may have the benefit of supporting validation of the decision tool criteria.

DFG recommends broader application of appropriate water quality measurements. Turbidity measurements are prescribed for points up- and downstream of all newly constructed or reconstructed crossings of class I and class II watercourses. We recommend that measurements are also taken upstream of the plan area.

Different schedules for turbidity measurements are prescribed in "Year 1" and "Year 2." Year 1 is described as "through the first winter after a timber harvest is completed." It is unclear to us whether measurements will be required during operations on plans that are conducted over a period of more than one year. We recommend that "Year 1" measurements are required on all years that a plan is active.

The use of continuous dataloggers is prescribed for monitoring of water temperatures. Results of monitoring may be affected by calibration and placement of equipment. Protocols for use of continuous dataloggers exist. The protocol of the Fish, Farm, and Forest Communities (Taylor 1997) is an example. DFG recommends that the waiver prescribe a protocol for the use of continuous dataloggers.

Other Project Components Which May Affect Aquatic Habitat

There are some important components of salmonid habitat which are associated with water quality effects and timber harvesting which are not addressed in the general waiver conditions. These include fish passage barriers, large woody debris maintenance and recruitment, and water drafting. We recommend consideration of these elements in the waiver conditions. Where applicable, criteria for these elements should be consistent with the state's recovery goals for coho salmon.

Should you have questions regarding this report, contact Mr. Richard Fitzgerald, Environmental Scientist, at (707) 944-5568; or Mr. Richard Macedo, Senior Environmental Scientist, at (707) 928-4369.

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