Bull Trout Peer Review Questions **July 3, 2002**

Context

We have defined "upper optimal" as the estimate of the higher end of thermal conditions known to support the life stages and biological functions of bull trout. We are assuming that adverse effects are more likely to occur as temperatures rise above this thermal upper optimal.

For the purposes of this project review, the upper optimal temperatures are expressed as a 7 day average of the daily maximums (7DADM), also referred to as the maximum weekly maximum temperature (MWMT), which is the annual peak in the 7 day average of the daily maximum temperatures. Applied as a limit on summer maximum temperature the 7DADM is an average of maximum temperatures that may be experienced during the seven day period of the hottest 1-2 weeks of the year, though the average temperatures approaching the 7DADM can be experienced for longer periods depending on the magnitude of diurnal and seasonal swings in temperature. Because it is an average, some actual stream temperatures during the hottest days will likely be higher than this seven day average. To be in compliance during warm years, streams would need to be lower than this amount during most years.

Our discussions have been focused on juvenile rearing, although criteria are also intended to be protective of spawning, incubation, and migration. Juvenile rearing generally applies to those streams where the early rearing occurs prior to the juveniles dispersing to larger water bodies with a greater prey base. The current approach assumes seasonal drops in stream temperatures from the summer maximum will produce sufficiently cold water to provide for spawning and incubation needs during the fall. In site specific cases where bull trout spawn in July or early August, it is intended that adjustments to the criteria be regulated on a site specific basis.

The upper optimal temperature is proposed for application to the furthest downstream extent of the applicable use by bull trout. How the furthest downstream extent of the use will be defined and evaluated has not yet been determined.

Our recommendation would be applied to protect all native char, which include bull trout and Dolly Varden. The overall goal is to maintain viable bull trout populations. We have interpreted to goal of maintaining viable bull trout populations as promoting the following characteristics of salmonid populations:

- Population size is large enough to:
  - Maintain genetic and phenotypic diversity over the long term;
  - Survive environmental variation and catastrophic disturbance;
  - Provide ecological functions

- Population distributions:
  - Allow full utilization of habitat potential (temporally and spatially) of sub-basins, which allows natural expression of multiple life history strategies;
  - Are comprised of well-connected sub-populations.

Questions (to be considered in the above context):

The technical work group has attempted to identify the upper optimal temperature for bull trout. This upper optimal temperature has been identified by members of the workgroup as existing somewhere between 11-13°C (7DADM), but we are seeking resolution on this.

Given that we want to fully protect juvenile rearing, is there an important difference in the level of protection offered by the three temperature proposals (11, 12, 13°C 7DADM)? If so, what is the difference? If not, why not. Which of these three proposals can be reasonably defended as being upper end of optimal defined in our process? Should the temperature criterion be set lower or higher than those identified here?

What is the significance of the risk (effects on key life processes, such as growth, reproduction, competitive ability, disease, survival, fecundity, ability to feed and hold territories, ability to respond to environmental stress, etc.) presented under typical field conditions from lack of available food, and disease if we set the threshold at: 11°C 7DADM?, 12°C 7DADM?, or 13°C 7DADM? Does research or information exist to support the assumptions on limited food availability in streams at these temperatures? How important is the role of temperature in allowing bull trout to maintain strong, healthy populations in the face of potential competition from brook trout and rainbow trout? Are there temperatures associated with dominance by bull trout, codominance, or loss of dominance in competition with other salmonid species?

What is the risk (to individuals and populations) involved in setting a temperature criterion at 1 or 2°C below the upper end of optimum vs. 1 or 2°C above the upper end of optimum?

If the upper optimal are only achieved every 9 out of 10 years, what is the risk to the population?

What level of risk is there to the population if there is not optimal growth for 2- 4 weeks of the year?

Of the three temperatures, does any one of them more adequately account for the uncertainties of translating laboratory thresholds to the field? Would the uncertainty rise to a level that would cause a likely risk to bull trout populations?

Which of these thresholds applied as the upper limit on summer maximum water temperatures will also typically protect spawning and incubation in the fall and winter?

Is it warranted to establish separate spawning season criteria, and if so what would be most appropriate as expressed as a highest permissible 7DADM applied to the starting date of the natural spawning period? Is 10°C 7DADM an appropriate criterion for protection of summer spawners (prior to Sept. 21) applied to the starting date of the natural spawning period on a site specific basis? Standards are normally applied to the well-mixed flow in the stream reaches providing critical habitat. If summer spawning by bull trout takes place under unique local conditions (e.g., associated with cold groundwater influences), should the standard apply only to the local areas (e.g., refugia)

and not the well-mixed flow? This question basically asks whether summer-spawning bull trout utilize unique streams that are colder than the majority of bull trout streams and would provide the very cold spawning and egg incubation temperatures needed. Would specific criteria need to be developed to be protective of these early spawners to ensure that water temperatures are not raised?

Do migratory fish (adults and subadults) face the same risks with these numbers as fish of other life stages do? Can you describe the risks to migratory populations using the range 12-16°C 7DADM? Provide special focus on whether establishing summer maximum temperatures of 16°C 7DADM (currently proposed to protect most salmon and trout waters) would likely harm the individuals and the population?

After reading the 3 review papers and EPA's criteria recommendation below:

Have we used the research appropriately in our assessments? Was the work interpreted correctly in the 4 review papers? Did we omit any important research or concepts in thermal ecology? In EPA's recommendation omit any important research or concepts in thermal ecology?

Should any of the lines of evidence used in determining upper optimal be weighed more heavily than others based upon strengths and weaknesses of the research, and applicability to field conditions?