ALBERT P. BARKER
JOHN A. ROSHOLT
JOHN K. SIMPSON
TRAVIS L. THOMPSON
SHELLEY M. DAVIS
PAUL L. ARRINGTON
SCOTT A. MAGNUSON
SARAH W. HIGER

BARKER
ROSHOLT
&
SIMPSON
LLP

1010 W. Jefferson, Suite 102
Post Office Box 2139
Boise, ID 83701-2139
(208) 336-0700 telephone
(208) 344-6034 facsimile
brs@idahowaters.com

113 Main Avenue West, Suite 303
Twin Falls, ID 83301-6167
(208) 733-0700 telephone
(208) 735-2444 facsimile
jar@idahowaters.com

Sarah W. Higer
swh@idahowaters.com

September 2, 2011

Paula J. Wilson
Hearing Coordinator
Department of Environmental Quality
1410 N. Hilton
Boise, Idaho 83706-1255

RE: Docket No. 58-0102-1102 - Rulemaking initiated to include a site specific temperature criterion for the Snake River to protect fall spawning of Chinook salmon from Hell's Canyon Dam to the Salmon River

Dear Paula,

Barker Rosholt & Simpson submits these comments and exhibits on behalf of the Idaho Power Company, in support of the Idaho Department of Environmental Quality's Proposed Rulemaking to include a site specific temperature criterion for the Snake River to protect fall spawning of Chinook salmon from Hell's Canyon Dam to the Salmon River.

Thank you for the opportunity to submit these comments.

Very truly yours,

BARKER ROSHOLT & SIMPSON LLP

Sarah W. Higer

SWH/hr
Encl.

I. INTRODUCTION

The purpose of the temperature criteria is to protect the most sensitive beneficial use. In the Hells Canyon Reach of the Snake River, the most sensitive beneficial use is that of Snake River fall Chinook salmon (SRFCS) spawning. The Snake River fall Chinook salmon (*Oncorhynchus tschawytscha*) was listed as a "threatened" species under the Endangered Species Act in 1992. The body of scientific evidence establishes that this particular beneficial use, SRFCS spawning, is protected by Idaho Power's proposed site-specific criteria (SSC). The purpose of the SSC, and any temperature criteria standard, is to protect the most sensitive beneficial use, not rote adherence to general guidelines that were adopted across a wide spectrum of beneficial uses.

II. HISTORY OF THE SALMONID SPAWNING SITE-SPECIFIC CRITERIA FOR THE SNAKE RIVER BELOW HELLS CANYON

In 2006 Idaho Power Company (IPC) submitted a site-specific criteria proposal to the Idaho Department of Environmental Quality (IDEQ) for SRFCS spawning temperature in the Snake River below the Hells Canyon Complex (HCC). The purpose of the proposal was to initiate an informal forum to discuss the SSC preliminary to a formal petition for rulemaking. The proposal was submitted for review only to IDEQ because the Oregon Department of Environmental Quality (ODEQ) indicated it preferred to participate in the process as an observer. IPC proposed a SRFCS spawning criterion 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 a 0.2°C daily rate of decline through November 10. From November 11 through April 15, the daily maximum temperature was not to exceed 13°C. These SSC were to be applied to the Hells Canyon Reach of the Snake River from Hells Canyon Dam at River Mile (RM) 247.6 to the Oregon/Washington border at RM 176.1.

The IDEQ held a meeting to discuss the technical merits of IPC's SSC proposal. In attendance were: IDEQ, ODEQ, U.S. Environmental Protection Agency (EPA), National Marine Fisheries Service (NOAA), U.S. Fish and Wildlife Service (USFWS), Idaho Department of Fish and Game (IDFG), Columbia River Inter-Tribal Fish Commission (CRITFC), Nez Perce Tribe (NPT), Idaho Rivers United (IRU), and American Rivers (AR). The group raised several issues, including a concern that the proposed SSC of 16.5°C was at the "edge of the envelope" or edge of the threshold of mortality for fall Chinook salmon. *See IF&G Comments* (Aug. 16, 2006) at 2-3. Oregon Department of Fish & Wildlife (ODFW) commented that site-specific criteria may be merited, with a declining thermal regime, but that 16.5°C was too high because it did not provide a sufficient "buffer." *ODFW Comments* (Aug. 18, 2006) at 1. U.S. Fish & Wildlife stated that a temperature level above 13°C appeared to be warranted, and recommended a 16°C temperature criteria as protective of bull trout. *USFWS Comments* (Aug. 16, 2006) at 2. NOAA Fisheries, the agency charged with evaluating and protecting anadromous salmonids, including SRFCS, concluded that the 16.5°C proposal "is protective of Snake River fall Chinook salmon based on its review of spawn-timing, fall cooling of the temperature regime, and likely effects on subsequent emergence and migration timing." *NOAA Fisheries Comments* (Aug. 28, 2006) at 2. Indeed, NOAA concluded that applying the 13°C guidance as of October 23 of each year was detrimental because it would "result in lower survival rates for a substantial proportion of the migrating subyearling fall Chinook salmon smolts in the Lower Snake and Columbia Rivers. *Id.*

The Nez Perce Tribe commented that 14.5-15.0°C should be the "outer boundary" and that even if temperatures could be as high as 15.5°C and protect the fisheries, that did not mean that the temperature criterion should be set there. *NPT Comments* (Aug. 23, 2006) at 6-7. CRITFC agreed that spawning thresholds above 13°C were demonstrated in the literature, but argued that the 16.5°C proposal was insufficiently protective of SRFCS. *CRITFC Comments* (Aug. 23, 2006) at 16-17. Some of the commenters argued that the 16.5°C proposal would result in a standard with no inherent added protection as required whenever the species targeted by the standard is protected under the Endangered Species Act (ESA). One specific concern was with potential temperature changes downstream of the compliance location of Hells Canyon Dam. If water temperatures were to increase in a downstream direction, the commenters proposed that compliance may not ensure that fall Chinook salmon embryos would not be exposed to temperatures higher than the standard. Further, inquiry was made about accuracy of equipment used to measure temperature both in the river and at the compliance point and the accuracy of the temperature equipment involved in the Battelle study used as the primary information in support of the proposed SSC. Others also noted a desire to include an explicit margin of safety to ensure protection of the resource.

In 2010 IPC submitted a new petition to IDEQ for SSC below HCC that substantively addressed the previous comments expressed in response to the 2006 proposal. The new proposal documents that water temperature during the spawning period does not increase in a downstream direction from Hells Canyon Dam. The proposal includes a margin of safety to account for potential instrumentation accuracy and presents the scientific rationale as to how the proposal would protect the beneficial use of SRFCS spawning and incubation. Even though NOAA Fisheries found the earlier petition "fully protective" of SRFCS spawning, this new petition presents a modified approach with a lower initiation temperature in a good faith response to the comments on the 2006 proposal.

III. NEGOTIATED RULEMAKING

On June 21, 2011, IDEQ held a negotiated rulemaking meeting on IPC's proposal to establish a SSC for SRFCS spawning in the Snake River between Hells Canyon Dam and the confluence with the Salmon River. The meeting was attended by representatives of Idaho Fish and Game, Idaho Department of Lands, EPA, NOAA, CRITFC, Confederated Tribes of Umatilla Indians, Nez Perce Tribe, Idaho Rivers United and American Rivers, in addition to Idaho Power and IDEQ. During the meeting, John Palmer (EPA, present by telephone) stated that EPA's comments in its letter to ODEQ regarding the SSC submitted by IPC for the State of Oregon's water temperature standard for salmonid spawning in the same reach of the Snake River also apply to the proposal of the SSC being considered in the Idaho negotiated rulemaking. Mr. Palmer reiterated those points with a slightly different emphasis at the meeting. The letter was made part of the public record in this rulemaking. Following the meeting, CRITFC, the Nez Perce Tribe and Idaho Rivers United, provided written submissions.

The following is IPC's response to several general issues raised by EPA and the other commenters. An effort has been made to group similar comments together under common headings and provide information on the topics raised, rather than provide a point-by-point response. IPC also notes that none of the commenters have stated that temperatures increase downstream of HCC, which takes that prior concern off the table. IPC has provided a more

detailed response to some of the technical arguments raised by CRITFC in a separate paper authored by Dr. Coutant (attached hereto as an exhibit). IPC has also provided copies of other relevant documents as exhibits for IDEQ's reference.

1. The HCC has created an unnatural environment for the Snake River fall Chinook salmon (CRITFC summary response 1).

This topic appears to be a more general attack on the presence of the HCC rather than a scientific discussion of the merits of the proposed temperature SSC. What the thermal regime was (pre-HCC) or may become (climate change) in the Snake River is not pertinent to the question posed by this proposed SSC. Similarly, the questions of if or how the proposed SSC would or could be met is not pertinent to the SSC. Nor is it relevant whether there may be very expensive engineering solutions that hypothetically could be implemented to achieve a 13°C temperature on October 23. The matter of a natural versus an unnatural thermal regime is also not the issue relative to this SSC. As CRITFC agrees, it is difficult to establish what the "natural" temperatures of the Snake River were, let alone recreate them. When temperature records began to be taken in the Snake River and elsewhere, many watersheds, including the Snake River, had already been altered by human activities. Not only is the natural thermal regime unknown, but the "natural rate of decline" referenced by CRITFC (summary response 4) is not known.

What is pertinent to this proposed SSC is whether the temperature criterion proposed would be suitable and protective of SRFCS spawning and incubation in the Snake River below the HCC. The revised proposed SSC is fully protective of spawning and incubation for SRFCS. The supporting science for this SSC is presented in the petition and discussed further in this response.

CRITFC argues that the life cycle of the SRFCS has been significantly altered by anthropogenic thermal shifts. This is not entirely correct. The thermal shift in the Snake River has not significantly altered the life cycle of SRFCS. Quite the contrary, the thermal regime of the Hells Canyon Reach of the Snake River has allowed the life history of SRFCS to produce primarily an Age-0 life history (which was the dominant life history upstream of the HCC prior to construction) and maintain that life cycle (Connor et al. 2002). Prior to construction of the HCC, Hells Canyon was primarily a migration corridor. It was not used to support salmonid spawning and incubation because it was too cold during the incubation period, similar to the Salmon River today (Connor et al. 2003; Groves et al. 2007). With the thermal shift associated with the HCC, a thermal regime suitable for spawning and incubation has been established within the Hells Canyon Reach, and the timing of spawning, emergence, outmigration and adult returns does not substantially differ from what was displayed prior to construction of the HCC from the spawning reaches that were upstream of the HCC (Groves et al. 2007). This thermal shift has been beneficial for SRFCS because it has allowed the SRFCS life cycle to continue with spawning below HCC. The historic spawning habitat upstream of the HCC is presently not suitable to support spawning and incubation because the anthropogenic effects of high sediment and nutrients renders the spawning and incubation habitat unsuitable (Groves and Chandler 2005).

The Columbia River has also experienced a similar thermal shift, largely from the presence of Lake Roosevelt (Grand Coulee Dam). This thermal shift has also favored fall Chinook salmon in the Hanford Reach of the Columbia River below Grand Coulee Dam, which now represents the

most productive population of fall Chinook salmon in the Columbia River basin. In fact, the thermal regimes of the Hells Canyon Reach and the Hanford Reach during spawning and incubation are very similar, as shown in the original proposal and discussed later in this response. The primary life cycle change to SRFCS that can be attributed to altered thermal regimes is that of the Clearwater River which also supports SRFCS. The thermal regime created in the Clearwater River by the release of cold water from Dworshak Reservoir has allowed an Age-1 type life history to develop, which is not the typical life history or life cycle of SRFCS. The Age-1 life history is primarily due to late emergence timing of incubating fish and a thermal shift towards a colder environment in the lower Snake River reservoirs during the summer months that have allowed that life history to survive over summer conditions in the lower Snake River rather than migrating to the ocean as a typical Age-0 migrant.

The significant point here is that IPC is asking the Department to evaluate and recognize the temperature requirements of the SRFCS that currently occupy the Snake River, and not some hypothetical thermal requirements or conditions of a population that existed before the HCC was built.

2. Criterion on a site-specific basis would need to be based on unambiguous new scientific information and analysis (EPA letter).

EPA suggests that it is only appropriate to revise a water quality criteria if there is "new" information since the original standard was established. EPA points to no such requirement in the law or its regulations. Nevertheless, the petition does contain new information specific to Snake River fall Chinook salmon that was not available at the time the EPA Region 10 Guidance For Pacific Northwest State and Tribal Temperature Water Quality Standards (EPA Region 10 Temperature Guidance) were developed in 2003. The specific new information is Geist et al. (2006), which is a peer-reviewed, published study in the *Transactions of the American Fisheries Society*. This study was well designed with statistical replication to address the question of embryo survival of Snake River fall Chinook salmon relative to a declining thermal regime and different initial daily maximum temperatures. In contrast, EPA's temperature guidelines were set primarily from studies using constant thermal regimes, which are not consistent with the conditions of the river below HCC. As part of the publication process, the American Fisheries Society sought review by Dr. William Connor (USFWS- SRFCS researcher) and John Jensen (retired Pacific Biological Research Station, BC, Canada) two well published authors on temperature and life history studies of Chinook salmon. Compared to the studies cited in the EPA Region 10 Temperature Guidance, it is clear that the peer-reviewed Geist et al. (2006) is the best scientific information available on the question of thermal effects at initiation of spawning and incubation for fall Snake River Chinook salmon in a declining thermal regime. Other leading scientists in the field of fisheries biology and Chinook salmon biology agree that this study offers the best scientific information available and that the review encompassed the available information. (*See* reviews of this SSC proposal by Dr. Charles Coutant and Dr. Dudley Reiser that are part of the public record for this rulemaking).

Second, the standard for establishing a site-specific criterion is not that the science is "unambiguous" as suggested by the EPA's letter to ODEQ. Under Idaho regulations (approved by EPA) site-specific standards are appropriately developed based on "scientifically defensible

procedures" such as laboratory studies and the scientific literature. IDAPA 58.01.02.275.01. Likewise, EPA's regulations for establishing water quality criteria state that the criteria must be based on "sound scientific rationale" using "scientifically defensible methods." 40 C.F.R. 131.11. The Geist et al. 2006 study was subjected to rigorous scientific peer review in a highly respected scientific journal. There are many examples where the science around specific issues is not "unambiguous" but that should not impede serious evaluation and consideration of the science that does exist. The resource and regulatory agencies typically act based on the best available science, which in this case is set forth in this SSC petition. (*See* Dr. Coutant's review.)

Third, and most importantly, what is "unambiguous" in the science relative to this SSC is that incubation survival for fall Chinook salmon in the Snake River and in the Columbia River under a declining thermal regime with initial daily maximum temperatures ≤16°C does not differ. Accordingly, an initial spawning temperature which incorporates that standard is fully protective of the beneficial use of Snake River fall Chinook spawning in these waters.

3. Why does this river segment and population of fall Chinook salmon require less stringent criteria than fall Chinook in other Oregon Rivers? (EPA Letter)

EPA questions whether this SSC must be consistent with all other temperature standards for fall Chinook. If this comment, suggesting that there must be criteria consistency, were taken to its logical extreme, no site-specific criteria could ever be developed. However, EPA Region 10 Temperature Guidance (at 34, section VI.1.A), the CWA, EPA regulations (40 C.F.R. 131.11), Idaho's regulations (IDAPA 58.01.02.275) and Oregon's regulations (OAR 340-041-0028(13)) all recognize that it is appropriate to establish site-specific criteria based on characteristics of the local water body and the species inhabiting those water bodies. In the negotiated rulemaking session, Mr. Palmer orally expanded this reference from the Oregon letter to include other rivers "in the Pacific Northwest." Perhaps nothing more is intended by these comments than to say that the SSC proposal must be supported by an explanation of why it is appropriate for local conditions.

This SSC proposal is based on published information in a scientific peer reviewed journal that includes two stocks of fall Chinook salmon: the Snake River (Geist et al. 2006) and the Columbia River (Olson and Foster 1955). Another report published by Battelle/Pacific Northwest Laboratory specific to the Hanford Reach of the Columbia River was also used to develop the petition (Olson et al. 1970). This information collectively demonstrates that a temperature threshold of an initial daily maximum temperature of approximately 16°C or less under a declining thermal regime fully protects the incubation of fall Chinook salmon eggs upon spawning. This information is provided in the petition. As to other Idaho, Oregon or Northwest rivers, the proposed SSC for the Hells Canyon Complex is likely to be protective of other stocks of fall Chinook salmon in other Idaho, Oregon and Northwest rivers. However, IPC has not evaluated the local conditions in other Pacific Northwest rivers and therefore cannot specifically answer the question as to those other rivers, with the exception of the Hanford Reach of the Columbia River – as explained in the petition. There are, however, many examples where fall Chinook salmon initiate spawning near 16°C. A SSC is appropriate when site-specific information is available that suggests divergence from the existing standard is still protective of the beneficial use. The information contained in the petition should be considered specific to the

Hells Canyon Reach of the Snake River, regardless of the status or standard of other Pacific Northwest rivers.

Data from the lower Columbia River demonstrates that fall Chinook salmon are spawning in temperatures well above the 13°C criterion. In the Ives Island area, initial spawning temperatures have been reported as high as a daily maximum of 17°C (2005). While not all reports were readily available for review, reports from 1998-2002, 2005 and 2006 result in an average daily maximum temperature of 15.3°C at the initiation of spawning.

Table 1. Daily Maximum Temperature (°C) on Initial Spawn Date for Fall Chinook Salmon at Ives Island in the Lower Columbia River.

Year	Daily Max. Temp (°C)	Initial Spawn Date	Citation
1998	16.0	26 Oct	van der Naald et al. 1999
1999	16.0	5 Oct	van der Naald et al. 2001
2000	15.0	16 Oct	van der Naald et al. 2001
2001	15.0	22 Oct	van der Naald et al. 2003
2002	15.0	8 Oct	van der Naald et al. 2004
2003	*	21 Oct	Fish Passage Center
2004	Not reported	12 Oct	van der Naald et al. 2006
2005	17.0	7 Oct	Fish Passage Center
2006	12.9	17 Oct	Fish Passage Center
2007	*	30 Oct	Fish Passage Center
2008	*	1 Oct	Fish Passage Center
2009	*	23 Oct	Fish Passage Center
2010	*	2 Nov	Fish Passage Center
Average	15.3	17 Oct	

* Annual report not readily accessible to review.

Another example of a fall Chinook salmon population that initiates spawning at temperatures above 13°C is from the Klamath River in Northern California. Daily maximum temperatures in the years 2000 through 2009 range from 13.9°C to 16.2°C at the initiation of spawning with an average initial spawn date of October 16 (Table 2).

Table 2. Daily Maximum Temperature (°C) on Initial Spawn Date for Fall Chinook Salmon in the Klamath River, California.

Year	Daily Max. Temp (°C)	Initial Spawn Date	Citation
1993		25 Oct	Magneson et al. 2001a
1994		17 Oct	Grove et al. 2006a
1995		16 Oct	Grove et al. 2006a
1996		21 Oct	Grove et al. 2006a
1997		16 Oct	Grove et al. 2006a
1998		14 Oct	Grove et al. 2006a
1999		13 Oct	Grove et al. 2006a
2000	15.0	16 Oct	Grove et al. 2006a
2001	15.5	15 Oct	Grove et al. 2006a
2002	15.7	10 Oct	Grove et al. 2006b
2003	15.8	14 Oct	Grove et al. 2006c
2004	16.2	11 Oct	Grove et al. 2006d
2005	14.5	18 Oct	Magneson et al. 2006
2006	15.0	16 Oct	Magneson et al. 2008a
2007	13.9	16 Oct	Magneson et al. 2008b
2008	14.9	15 Oct	Magneson et al. 2010a
2009	14.2	14 Oct	Magneson et al. 2010b
Average	15.1	16 Oct	

The Hanford Reach of the Columbia River in the State of Washington also has fall Chinook salmon that initiate spawning above 13°C. As presented in Table 5 of the proposal, the Hanford Reach has a very similar thermal regime to the Snake River in Hells Canyon. Between 2006 and 2010, the average date of first observed spawning in the Hanford Reach was October 22 (Personal communication, Robert Mueller, PNL). The average date of first observed spawning in Hells Canyon is Oct 23.

The State of Washington has a different approach to salmonid spawning criteria than Oregon and Idaho. The Hanford Reach is designated for "salmonid spawning, rearing and migration" from September 16 to June 14. This designation is distinguished from "core summer salmonid

habitat" which has a date range of June 15 to September 15. The temperature criterion for "salmonid spawning, rearing and migration" is a 7-day daily maximum temperature of 17.5°C. Some Washington streams have a more stringent temperature criterion that is applied seasonally to further protect salmonid spawning and egg incubation. These criteria can be found in *Waters Requiring Supplemental Spawning and Incubation Protection for Salmonid Species*, published by the Washington Department of Ecology and attached as an exhibit. This publication states that "salmonid populations which begin spawning in the late fall or whose young have emerged from the stream gravels before late spring do not require added protection." *Waters Requiring Supplemental Spawning and Incubation Protection for Salmonid Species*, at 1. The Hanford Reach of the Columbia River is not designated in this publication as requiring any additional temperature protection. Therefore the "salmonid spawning, rearing and migration" criterion of a 7-day daily maximum temperature of 17.5°C daily maximum after September 16 applies to the Hanford Reach. Temperatures in the Hanford Reach on September 16 are generally around 20°C and around the time of spawning (Oct 22) are above 13°C. Clearly not all Pacific Northwest rivers have the same 13°C standard at average initiation of spawning. Nor is a 13°C initial spawning temperature required to protect the species as recognized in Washington's EPA approved water quality standards.

CRITFC refers to a 3-week shift in temperature that is present in the Hanford Reach, similar to what occurs in the Hells Canyon Reach, and describes this stretch of the Columbia River as an impaired system. The status of the population does not bear out this unsupported criticism. The population of fall Chinook salmon in the Hanford Reach is a thriving, healthy population. Importantly, it is not listed under the ESA, which strongly suggests that the present thermal regime there and below Hells Canyon is not the primary determinant of population health in these populations.

CRITFC comments expand the issue beyond other fall Chinook salmon stocks in the Pacific Northwest to all Chinook salmon (i.e. different races of Chinook salmon such as spring/summer (S/S) Chinook salmon). CRITFC disagrees with IPC's position that a "one size fits all" temperature criterion is not appropriate given differences in life histories of the various races of Chinook salmon. CRITFC even suggests that there are no physiological differences among the races of Chinook salmon despite having different life histories. There are several differences in life histories that do imply differences in thermal tolerances among the two races of Chinook salmon. These include temperature differences when juveniles out migrate and undergo smoltification (Sauter et al. 2001), timing and temperature differences during the adult migration periods (Healey 1991), and distributions in the ocean of the two races of Chinook salmon (Healey 1991). These differences warrant consideration of different thermal tolerances. Variations exhibited between stream type and ocean type Chinook salmon races are very large, but there is also considerable interpopulation variation among Chinook salmon within the two races (as CRITFC points out with fall Chinook salmon also having some proportion of Age-1 migrants). Chinook salmon demonstrate a large degree of variation among populations within the races and considerable plasticity to environmental conditions with a strong ability to adapt to local conditions (Healey 1991, Taylor 1991). It stands to reason that SRFCS are better adapted to return in warmer conditions than their stream-type (S/S Chinook) counterparts and also differ in their temperature tolerances. As an example, there is recent evidence of sockeye salmon populations (more closely related than races of Chinook salmon) within the Fraser River system

demonstrating different thermal tolerances (Eliason et al. 2011). It is certainly not unreasonable to conclude from this evidence that there are different thermal tolerances among Chinook salmon races.

While there may be uncertainty on the extent of differences that exist in thermal tolerances among the different races or populations of Chinook salmon or among the different Pacific salmon species, demonstrating what these thermal differences are across the different streams and different populations is not necessary relative to this SSC petition. The question is simply whether this SSC proposal is protective of the beneficial use of SRFCS spawning. There is ample scientific evidence that fall Chinook salmon in the Snake River would be fully supported and protected under the SSC proposal and that the "one-size fits all" criterion for all salmonids is not necessary to protect Snake River fall Chinook salmon. Based on the studies conducted in the Hanford Reach of the Columbia River (Olson et al. 1970 and Olson and Foster 1955) on fall Chinook salmon, the proposed criteria would fully protect that stock of salmon as well.

The EPA Region 10 Temperature Guidance recognizes that the guidance does not preclude states or tribes from adopting different standards than those described in the guidance. *EPA Region 10 Temperature Guidance*, at 1-2. The guidance is just that, a guidance, not a rule. Approval of a state standard does not depend on whether the standard is consistent with this or any other guidance document, but that it protects the designated beneficial use – here SRFCS spawning. *EPA Region 10 Temperature Guidance*, at 4. The proper question then is not whether this SSC matches a state rule that simply adopted EPA Region 10 Temperature Guidance, but whether, as here, the criterion protects SRFCS spawning.

In comments on EPA's Draft Region 10 Temperature Guidance, Oregon expressed concern that EPA's temperature criterion was pegged at the "upper end" of the "optimal" range of thermal conditions. *ODEQ Comments on EPA Draft Region 10 Temperature Guidance*, at 4-5. ODEQ felt the proposed criterion failed to recognize that beneficial uses occur in many times and locations where the "optimal" temperature is not attainable and also failed to recognize that limited exposure to temperatures above these optimal conditions could occur with no measurable impact on the beneficial uses. *Id.* ODEQ also noted that to protect the agencies' scientific integrity, the agencies must be able to recognize when the guidelines are not the appropriate or necessary standard to protect a beneficial use in a particular time or location. *Id.*

BLM made similar comments, observing that EPA Region 10 Temperature Guidance guidelines were established at "near optimum" conditions based on studies employing constant temperatures, and that these constant temperature studies did not replicate the natural, and variable, conditions found in the streams. *BLM Comments on EPA Draft Region 10 Temperature Guidance*, at 1. Rather, BLM remarked, the CWA requires that the standards support the beneficial uses and "[t]he protection and propagation of indigenous populations does not require 'near optimal' temperatures. There is a range of temperatures in which there is good propagation of these species." *Id.* The natural variations and declining fall temperatures are strong reasons to accept this SSC proposal, rather than rely upon the "one-size fits all" approach criticized by ODEQ in its comments on EPA's draft Region 10 Temperature Guidance. *ODEQ Comments on EPA Draft Region 10 Temperature Guidance*, at 1. Both FWS and NOAA Fisheries praised the provisions in the final Region 10 temperature guidelines which recognize the inherent variability

of Pacific Northwest rivers and provide for flexibility in developing criteria that reflect the diversity of the aquatic landscape across the region and allow for adoption of different criteria rather than a "one size fits all" approach. *FWS April 21, 2003 Letter to EPA*, at 3; *NOAA Fisheries April 23, 2003 Letter to EPA*, at 1-2.

Consequently, it is appropriate under both the scientific evidence supporting the SSC presented in this proceeding, and under Idaho and EPA regulations and guidelines to recognize a SSC for the river below HCC that protects SRFCS, even though it differs from criteria set for other rivers and other stocks.

4. The appropriate start date should be considered in the rulemaking.

The EPA Region 10 Temperature Guidance provides:

> EPA recommends this use for the protection of water bodies used or potentially used for salmon and trout spawning, egg incubation, and fry emergence. Generally, this use occurs: (a) in spring early summer for trout (mid-upper reaches); (b) in late summer-fall for spring Chinook (didapper reaches) and summer chum (lower reaches); and (c) in the fall for coho (mid-reaches), pink, chum, and fall Chinook (the latter three in lower reaches). EPA recommends a 13°C maximum 7DADM criterion to protect these life stage uses for salmon and trout and recommends that this use **apply from the average date that spawning begins** to the average date incubation ends (the first 7DADM is calculated 1 week after the average date that spawning begins). Meeting this criterion at the onset of spawning for salmon and at the end of incubation for steelhead trout will likely provide protective temperatures for egg incubation (6 - 10°C) that occurs over the winter (salmon) and spring (trout), assuming the typical annual thermal pattern.

EPA Region 10 Temperature Guidance, at 31 (*Salmon and Trout Spawning, Egg Incubation, and Fry Emergence - 13°C 7DADM*) (emphasis added).

Both the current standard and the proposed SSC follow this guidance. During the period 1990-2010, IPC and the FWS have monitored redd construction timing and distribution by aerial surveys. The average initial observed redds between Hells Canyon Dam and the confluence with the Salmon River for the past 20 years is October 23. Thus the start date associated with the current spawning temperature criteria is consistent with the EPA Guidance and appropriate under the proposed SSC. IPC is not proposing a change in the start date with this SSC.

EPA's letter to ODEQ suggesting that the start date for the temperature criterion should begin on either the 1st or 15th of the month would be inconsistent with EPA's own Region 10 Temperature Guidance, which bases the start date on the average date that spawning begins. IPC does not understand why EPA contends, based on the data, that the average start date of SRFCS spawning in the Snake River is anything other than October 23. However, a November 1 start date would be consistent with the current Oregon salmonid spawning criteria identified in Figure 151B for the Snake River segment from the Salmon River to the Oregon/Washington border (OAR 340-041-0028 (4)(a)).

The main point here is that the average date of first spawning of SRFCS in Hells Canyon is October 23. That is the appropriate start date for the spawning temperature criteria.

5. EPA raises a concern that the Geist et al. (2006) study held adults pre-spawn at 12°C prior to spawning at the differing temperature regimes included in the study, and that fall Chinook salmon adults in the Snake River are exposed to much higher pre-spawning temperatures and therefore question the applicability of the study.

The difficulty with responding to this concern is that it calls into question all of the data used to develop the temperature criteria in the first place. Virtually every study cited in the development of the EPA Region 10 Temperature Guidance that was used to evaluate egg incubation survival under various thermal regimes involved conditions where the pre-spawn thermal history is not known or is not comparable to pre-spawn conditions fish would experience. The pre-spawn history of adults used in these cited studies is not known, except in some cases where they were held in a hatchery for some period or when the adults may have been subjected to some pre-spawn thermal regime. Even in those studies where adults were held in a known pre-spawn thermal regime, the thermal history prior to capture is not known or reported. In many cases, the pre-spawn holding temperature is not even reported in the evaluation. IPC believes it is unfair to rest on this criticism unless EPA holds all the other studies used in their guidelines to the same standard they are using to question the applicability of the Geist et al. (2006) study.

Even so, the Geist et al. (2006) study is not the sole basis of the IPC proposal. There are two other applicable studies cited in the petition (also used in the EPA Region 10 Temperature Guidance) that are used as the primary basis of the supporting science of the petition: Olson et al. (1970) and Olson and Foster (1955). All three studies used adults from different sources and different pre-spawn thermal histories. The Olson and Foster (1955) study used a pair of adults collected from the spawning grounds in the Hanford Reach of the Columbia River on October 26. The thermal history of these fish is not known. It is not possible to know when those fish entered the Columbia River and what temperatures they experienced before being collected from the spawning ground. The Olson et al. (1970) study used four different spawning pairs from Priest Rapids Hatchery on four different dates (Oct 30, Nov 14, Nov 23 and Dec 8). Again, the pre-spawn time period these fish were in Priest Rapids Hatchery and the thermal conditions they experienced prior to the hatchery is not known. The Geist et al. (2006) study used 10 females and 10 males from the Lyons Ferry Hatchery spawning on Nov 22. The period of time these fish were held at Lyons Ferry at 12°C is not known. These fish were either trapped at Lower Granite Dam or were volunteer swim-ins to the hatchery. It is not known when these fish were captured or what their thermal experience was prior to the hatchery. Yet, despite these differences in the sources of the adult fish among the three studies, the differences in sample size from different dates and locations and the likely different pre-spawn thermal histories, the conclusions of the three embryo survival evaluation studies are very similar. Regardless of their pre-spawn temperature exposures, they all suggest a threshold value where the initial thermal exposure of fertilized eggs begins to influence egg survival. All studies suggest that threshold value is approximately 16 - 16.5°C. Relative to establishing a spawning / incubation criteria, these studies do properly answer the question of thermal effects on embryo survival. They are the best scientific information available specific to Snake River and Columbia River stocks of fall

Chinook salmon. Indeed these studies suggest that a higher temperature could be used (an initial daily maximum of 16°C) than that proposed in this SSC petition.

6. SSC should address the adult migration (late summer) through fry emergence (April) period.

Both EPA and CRITFC raise the issue of warm late summer and early fall temperatures relative to gamete viability and pre-spawn survival. These comments relate to the existing 20°C migration period standard designed for protection of migrating adults in the pre-spawn period. IPC is not proposing to change this criterion. It is not clear how EPA has established a relationship of significance between the 13°C spawning criteria to the 20°C migration period standard. It is also not clear how CRITFC is establishing this link. In fact, the 2003 EPA Region 10 Temperature Guidance does not examine this relationship. Nevertheless, EPA, Idaho and Oregon have established the 20°C standard as protective of the migratory corridor including, presumably pre-spawn gametes. This proposal does not seek to alter that standard.

Literature available to assess pre-spawn temperature effects and gamete viability on spawning and incubation success for Chinook salmon is sparse at best. IPC is not aware of specific studies that can be related to the thermal conditions in the Snake River and pre-spawn mortality or reduced gamete viability. CRITFC claims that studies conducted by King et al. (2003) and King et al. (2007) for Atlantic salmon held at high constant thermal regimes are relevant to fall Chinook salmon. IPC is aware of these studies relative to Atlantic salmon. CRITFC does not establish how detrimental effects for Atlantic salmon held for prolonged periods at constant temperatures of 22°C as in the King et al. studies can be extrapolated to Snake River fall Chinook salmon that are not exposed to this type of thermal regime. Fall Chinook salmon in the Snake River are exposed to declining thermal regimes and also have access to significant thermal refugia. The true thermal histories of SRFCS are much different than the exposures the Atlantic salmon experienced in these studies. IPC agrees that these studies support the idea that thermal experiences during pre-spawn periods can affect viability of gametes in salmonids, but that is the extent that these studies can be applied to this question. CRITFC also makes comparisons of thermal tolerances between juvenile Atlantic salmon and Chinook salmon, but fails to make a clear link as to how those differences relate to tolerances of adults and gamete viability after exposure of adults to higher temperatures. IPC is also aware of studies conducted by Jensen et al. (2006) specific to summer Chinook salmon stocks, but the thermal regimes used in these evaluations are not comparable to thermal conditions that fall Chinook salmon stocks experience in the Snake River or Columbia River.

There are several studies in the EPA guidelines cited to support pre-spawn gamete viability concerns, but when closely evaluated many of these studies are for species other than Chinook salmon, in many cases are not designed to address the question with statistical rigor, or the findings do not support the conclusions. The majority of these studies are not published peer reviewed articles (*see* Groves et al. 2007 for a review of this literature).

Regardless of these uncertainties on the effects of pre-spawn thermal temperatures, it is important to emphasize that these arguments on pre-spawn conditions and the 20°C criterion in place to protect the adult migration of salmon and steelhead do not relate to this SSC proposal.

This SSC only influences developing gametes past October 23, water temperatures during or after that time would not be expected to influence gamete survival. For example, even the Atlantic salmon relied upon by CRITFC had acceptable gamete survival at the 18°C constant environment.

CRITFC asserts that high water temperatures until late October would not promote early emergence of juvenile fall Chinook salmon, implying that spawn timing would initiate earlier under cooler thermal conditions. There is no evidence that spawn timing has changed significantly relative to pre-HCC spawn timing in historic habitats. Initiation of spawning may have been slightly earlier, but the overall median spawn date has not changed. This is evident in Evermann (1896) descriptions of Snake River spawning and in Zimmer (1950) descriptions of spawning of fall Chinook salmon.

7. Increased hatchery returns as an indicator that the current temperature regime in the Hells Canyon reach of the Snake River is protective of fall Chinook salmon.

The number of wild fish has increased substantially since 1990, when only 45 wild redds were observed in the Snake River. EPA suggests that the available estimates for wild returns have not increased in proportion to the overall run increase. CRITFC and the NPT raise similar concerns (*CRITFC summary response*, at 3; *NPT Comments*, at 3.), and credit recent high returns to the supplementation program. CRITFC even claim, based on no data, that "it is not likely that the wild component of the run would be able to sustain itself" were it not for the supplementation program. *CRITFC summary response*, at 2. However, there is some evidence that hatchery supplementation in general may reduce productivity of wild stocks (Chilcote et al. 2011). This question is the primary focus of the additional studies suggested in the Addendum to the Hatchery Genetic Management Plan for Snake River Fall Chinook Salmon Hatchery Programs (July 18, 2011). It stands to reason that high population numbers in recent returns of both hatchery and wild components of the SRFCS are certainly indicative of a successful population under the current conditions (which in some years have been warmer than this proposed SSC criterion for initiation of spawning), whether wild or supplemented. Supplementation would not have been successful if the habitat had not been suitable. Neither CRITFC nor any other commenter shows why even the current temperatures are harmful to any SRFCS, wild or hatchery-raised.

However, the true wild component of the run is not known since hatchery supplementation levels began to increase substantially in the early 2000s. Because a large number of hatchery fish that are released upstream of Lower Granite Dam are not marked, it is necessary to reconstruct the adult returns to estimate proportions of wild and hatchery fish and age composition. The methodology to reconstruct the runs prior to 2010 has been determined to be inaccurate and there will most likely be a re-estimate under a different methodology to derive more accurate estimates of wild/hatchery proportions (*See Addendum to Hatchery Genetic Management Plan for Snake River Fall Chinook Salmon Hatchery Programs*, July 18, 2011). Nonetheless, the method applied in 2010 demonstrates that wild fish returns have increased substantially over the last 20 years. The 2010 estimate for wild fall Chinook salmon returns above Lower Granite Dam is 10,187 or approximately 25% of the adult return. This is compared to an estimate of 78 wild returns in 1990. The total adult return in 2010 was over 42,000 fall Chinook salmon at Lower Granite Dam. In 2010, the NPT and the agencies also documented 5626 redds, exceeding the

2009 record by 1910 redds. *Federal Defendants' Reply in Support of Motion for Summary Judgment* (Feb. 11, 2011), at 1 (attached as exhibit). The influence that hatchery fish have on the production of wild fish is not certain, and will continue to be an evaluation need for years to come. Early season forecasts for Snake River fall Chinook salmon adult returns for 2011 are comparable if not slightly higher than the 2010 return with comparable numbers of wild fish, based on IPC communication with members of the fall Chinook salmon technical team comprised of agencies and tribes working on SRFCS. The Hanford Reach returns are also expected to be among the highest returns since 1964 based on Columbia River Fall Chinook 2011 Preseason Forecasts (*U.S. v. Oregon* Technical Advisory Committee Sub-group, Feb. 28, 2011; attached as exhibit).

Snake River fall Chinook salmon are the most heavily fished ESU that is listed under the ESA in the Columbia River basin. Harvest of SRFCS approaches 30 to 35 percent. In addition to commercial harvest in the ocean, they are also fished in tribal and recreational fisheries in both the Columbia River and the Snake River. Oregon and Washington have fall Chinook sport harvest season for the mainstem Columbia River from Buoy 10 to the Oregon-Washington border with adult limits and season dates varying by location. These mainstem Columbia River fall Chinook salmon fisheries allow harvest of non-adipose fin clipped adult salmon, of which a portion captured would include SRFCS. Both IDFG and ODFW have announced a 2011 sport harvest fishery in Hells Canyon for ad-clipped hatchery SRFCS with a six adult per day adult bag limit.

It is also curious that the United States EPA seems to be taking a position with respect to the status of SRFCS that is at odds with the position taken by the United States in proceedings before the federal courts concerning this very species. In 2009, the United States advised the *NWF v. NMFS* Court that SRFCS was one of the federal government's "stars", were above recovery levels and had been for many years:

> … These are recent numbers for Snake River Fall Chinook.… I'll admit Snake River Fall Chinook is doing great. That is a great ESU for us. It's one of our stars….
>
> These right here, Your Honor, those are recent -- that's 2007, 2008. And they are preliminary at this point. They haven't been vetted throughout the whole process and they gotta undergo all that stuff. But they're not going to move very far.
>
> This line, Your Honor, that's when they were listed. This line right here, that's the TRT minimum recovery threshold. So everything above that, according to the TRT, has recovered.
>
> So for five of the six last years Snake River Fall Chinook has been over the recovery criteria.

Transcript of Cross Motions for Summary Judgment Proceedings, March 6, 2009, at 76-77 (emphasis added) (attached as an exhibit).

In a 2011 proceeding before the same court, the United States introduced an exhibit showing the sharply increasing abundance trend for wild adults of Snake River fall Chinook (see attached exhibit showing wild adult returns at Lower Granite Dam). EPA's contrary position is unexplained.

8. Language of rule should be clear on how it is interpreted.

IPC believes that the revisions to the rule proposed by IDEQ following the negotiated rulemaking sessions provide the requested clarity.

9. Antidegradation.

Some commenters suggested that changing a water quality standard to relax the temperature criterion, no matter how slightly, violates the antidegradation rules and regulations. This comment represents a fundamental misunderstanding of antidegradation. Antidegradation does not prohibit adoption of new standards, site-specific or otherwise. Instead, it limits under certain circumstances the increase in a pollutant contained in a particular discharge. The site-specific standard proposes no new discharge and no increases in pollutants in any discharge. Moreover, IPC proposes no increases in temperature loads in its discharges under its FERC License proceedings. Antidegradation is irrelevant.

10. Climate Change.

Some commenters argued that climate change was a reason to reject any site-specific criteria. Future climate change is not relevant to the question of what temperatures fully protect the species below HCC (and Hanford for that matter). Rather, it would only be relevant to how often any standard is met, not what the standard should be.

11. HCC is not a Substitute for Dworshak Releases.

Some commenters have suggested that this SSC proposal be denied because adopting the SSC would make it more difficult to advocate for a program that would require HCC releases to substitute for cold water releases from the federal project at Dworshak. This criticism is so far afield from the scientific determination the IDEQ is being asked to make, i.e., what is a protective spawning temperature for SRFCS below HCC, that the criticism should be dismissed out of hand.

Dworshak is drafted by the federal agencies to meet flow targets at Lower Granite Dam and to provide temperature mitigation for the impacts of the four lower Snake River dams, which are operated by the federal agencies. The NPT in particular has been an advocate of using releases from Brownlee to replace some or all of the releases from Dworshak because of the economic impacts of reservoir draw-downs at Dworshak, which make the Clearwater River too cold to swim in. *NPT comments on 2006 SSC* (Aug. 23, 2006) at 2-3.

These comments are principally economic and political, or relate to passing the responsibility for conditions caused by the lower Snake River dams from the federal government agencies which operate those dams to a private entity which does not. In any event, these types of comments say nothing about the science behind this SSC proposal to establish spawning temperature standards for SRFCS.

Literature cited

Chilcote, M.W., K.W. Goodson, and M.R. Falcy. 2011. Reduced recruitment performance in natural populations of anadromous salmonids associated with hatchery-reared fish. Canadian Journal if Fisheries and Aquatic. Sciences 68: 511–522.

Connor, W.P., H.L. Burge, R. Waitt, and T.C. Bjornn. 2003. Juvenile life history of wild fall Chinook salmon in the Snake and Clearwater rivers. North American Journal of Fisheries Management 22:703-712.

Connor, W.P., C.E. Piston, and A.P. Garcia. 2003. Temperature during incubation as one factor affecting the distribution of Snake River fall Chinook salmon spawning areas.

Eliason, E.J., T.D. Clark, M.J. Hague, L.M. Hanson, Z.S. Gallagher, K.M. Jeffries, M.K. Gale, D.A. Patterson, S.G. Hinch, and A.P. Farrell. 2011. Differences in thermal tolerances among sockeye salmon populations. Science 332:109-112.

Evermann, B. 1896. A preliminary report upon salmon investigations in Idaho in 1894. Bulletin of the U.S. Fish Commission. Volume XV for 1895. U.S. Government Printing Office Washington, D.C. p. 253–284.

Fish Passage Center. http://www.fpc.org/

Geist, D.R., C.S. Abernathy, K.D. Hand, V.I. Cullinan, J.A. Chandler, and P.A. Groves. 2006. Survival, development, and growth of fall Chinook salmon embryos, alevin, and fry exposed to variable thermal and dissolved oxygen regimes. Transaction of the American Fisheries Society 135:1462-1477.

Grove, S., and M. Magneson. 2006d. Mainstem Klamath River fall Chinook salmon spawning survey 2004. U.S. Fish and Wildlife Service, Arcata Fish and Wildlife Office, Arcata Fisheries Data Series Report Number DS 2006-04, Arcata, California.

Grove, S., and M. Magneson. 2006c. Mainstem Klamath River fall Chinook salmon spawning survey 2003. U.S. Fish and Wildlife Service, Arcata Fish and Wildlife Office, Arcata Fisheries Data Series Report Number DS 2006-03, Arcata, California.

Grove, S., and M. Magneson. 2006b. Mainstem Klamath River fall Chinook salmon spawning survey 2002. U.S. Fish and Wildlife Service, Arcata Fish and Wildlife Office, Arcata Fisheries Data Series Report Number DS 2006-02, Arcata, California.

Grove, S., P.McNeil, and M. Magneson. 2006. Mainstem Klamath River fall Chinook salmon spawning survey 2001. U.S. Fish and Wildlife Service, Arcata Fish and Wildlife Office, Arcata Fisheries Data Series Report Number DS 2006-01, Arcata, California.

Groves, P.A., J.A. Chandler and R. Myers. 2007. White Paper: The effects of the Hells Canyon Complex relative to water temperature and fall Chinook salmon. Idaho Power Company. Boise, Idaho.

Healey, M.C. 1991. Life history of Chinook salmon *(Oncorhynchus tshawytscha)*. In: C. Groot and L. Margolis, editors. Pacific salmon life histories. University of British Columbia, Vancouver, B.C. Pages 313–393.

King, H.R., N.W. Pankhurst, M. Watts, and P.M. Pankhurst. 2003. Effect of elevated summer temperatures on gonadal steroid production, vitellogenesis and egg quality in female Atlantic salmon. Journal of Fish Biology 63:153-167.

King, H.R., N.W. Pankhurst, and M. Watts. 2007. Reproductive sensitivity to elevated water temperatures in female Atlantic salmon is heightened at certain stages of vitellogenesis. Journal of Fish Biology 70:190-205.

Magneson, M., and K. Wright. 2010b. Mainstem Klamath River fall Chinook salmon redd survey 2009. U.S. Fish and Wildlife Service, Arcata Fish and Wildlife Office, Arcata Fisheries Data Series Report Number DS 2010-19, Arcata, California.

Magneson, M. 2008b. Mainstem Klamath River fall Chinook salmon spawning survey 2007. U.S. Fish and Wildlife Service, Arcata Fish and Wildlife Office, Arcata Fisheries Data Series Report Number DS 2008-14, Arcata, California.

Magneson, M., R. Studebaker, and J. Ogawa. 2008a. Mainstem Klamath River fall Chinook salmon spawning survey 2006. U.S. Fish and Wildlife Service, Arcata Fish and Wildlife Office, Arcata Fisheries Data Series Report Number DS 2008-13, Arcata, California.

Magneson, M. 2006. Mainstem Klamath River fall Chinook salmon spawning survey 2005. U.S. Fish and Wildlife Service, Arcata Fish and Wildlife Office, Arcata Fisheries Data Series Report Number DS 2006-05, Arcata, California.

Magneson, M, P.McNeil, and T. Shaw. 2001. Mainstem Klamath River fall Chinook salmon spawning survey: fiscal year 2001. U.S. Fish and Wildlife Service, Arcata Fish and Wildlife Office, Arcata, California.

Olson, P. A., R.E. Nakatani and T. Meekin. 1970. Effects of thermal increments on eggs and young of Columbia River fall Chinook. Battelle Memorial Institute, Pacific Northwest Laboratories. BNWL - 1538, UC 48. Richland, Washington.

Olson, P.A., and R.F. Foster. 1955. Temperature tolerance of eggs and young of Columbia River Chinook salmon. Transactions of the American Fisheries Society 85:203-207.

Sauter, S.T., L.I. Crawshaw and A.G. Maule. 2001. Behavioral thermoregulation by juvenile spring and fall Chinook salmon, Oncorhynchus tshawytscha, during smoltification. Environmental Biology of Fishes 61:295-304.

Taylor, E.B. 1991. A review of local adaptation in Salmonidae, with particular reference to Pacific and Atlantic salmon. Aquaculture 98:185-207.

van der Naald, W., R. Clark, and B. Spellman. 1999. Evaluation of fall Chinook and chum salmon spawning below Bonneville, the Dalles, John Day and McNary dams. Project Number 1999-00301, BPA Report DOE/BP-15007-1. Bonneville Power Administration, Portland, Oregon.

van der Naald, W., B. Spellman, and R. Clark. 2001. Evaluation of fall Chinook and chum salmon spawning below Bonneville, the Dalles, John Day and McNary dams. Project Number 1999-00301, BPA Report DOE/BP-15007-2. Bonneville Power Administration, Portland, Oregon.

van der Naald, W., R. Clark, and B. Spellman. 2001. 2000-2001 evaluation of fall Chinook and chum salmon spawning below Bonneville, The Dalles, John Day and McNary dams. Project Number 99-003-01/99-003-02. Oregon Department of Fish and Wildlife, Portland, Oregon.

van der Naald, W., R. Clark, and B. Spellman. 2003. Evaluation of fall Chinook and chum salmon spawning below Bonneville, the Dalles, John Day and McNary dams. Project Number 1999-00301, BPA Report DOE/BP-00004028-2. Bonneville Power Administration, Portland, Oregon.

van der Naald, W., R. Clark, R. Brooks, and C. Duff. 2004. Evaluation of fall Chinook and chum salmon spawning below Bonneville Dam. Project Number 1999-00301, BPA Report DOE/BP-00004028-3. Bonneville Power Administration, Portland, Oregon.

van der Naald, W., C. Duff, T. Friesen, R. Brooks, and L. Tomaro. 2006. Evaluation of fall Chinook and chum salmon spawning below Bonneville Dam, 2004-2005. Project Number 1999-00301, BPA Report DOE/BP-00004028-5. Bonneville Power Administration, Portland, Oregon.

Wright, K, and M.Magneson. 2010a. Mainstem Klamath River fall Chinook salmon redd survey 2008. U.S. Fish and Wildlife Service, Arcata Fish and Wildlife Office, Arcata Fisheries Data Series Report Number DS 2010-18, Arcata, California.

Zimmer, P.D. 1950. A three year study of fall Chinook salmon spawning areas in Snake River above Hells Canyon Dam site. Report of Fish and Wildlife Service, Region 1. Portland, Oregon.

EXHIBIT:

Comments on CRITFC's June 24, 2011 Evaluation of Site Specific Criteria Proposal, by Dr. Charles C. Coutant (August 17, 2011).

Comments on CRITFC's June 24, 2011 *Evaluation of Site Specific Criteria Proposal*, authored by Dale A. McCullough and presented as Attachment 1 to the June 24 letter from Babtist P. Lumley, Executive Director of CRITFC, to Paula J. Wilson, Hearing Coordinator, Department of Environmental Quality.

Charles C. Coutant
August 17, 2011

Comments are keyed to page and specific paragraph of CRITFC's *Evaluation*. Each of my comments follows a brief quotation (italics) or summary (brackets) from CRITFC's *Evaluation* that identifies the topic of my comment.

Page 1, item 1:

> *The presence of the HCC in the Snake River has caused a 3-week shift in temperatures that presents an unnatural environment for the Snake River fall Chinook. ... Future climate change, which is considered to be highly likely to involve a significant water temperature increase in the Snake River, will potentially stress the fall Chinook beyond their capacity to adapt.*

The matter of natural versus unnatural is not the issue. It is whether a specific temperature regime is suitable for fall Chinook spawning and incubation in the first week of the current 13°C standard. Temperatures in the Snake generally are of genuine scientific concern for salmon populations, but the scientific evidence specific to the time period of the IPC proposal is most germane. Speculation about climate change is not pertinent to the specific request.

As CRITFC's later comments indicate, it is difficult to establish what the "natural" temperatures of the Snake River were, let alone recreate them. When temperature records began to be taken, the watershed had already been altered by human activities. Historical reconstructions indicate that "natural" for flows, and probably temperatures, is a fluid situation (e.g., impacts of snowpack: Pederson, G.T, et al. 2011. The unusual nature of recent snowpack declines in the North American Cordillera. Science 333:332-335.).

Page 2, item 2:

> *The fact that water temperatures do not often meet the standard by October 23 is not an indication that the standard needs to be changed. It is a reflection of the 3-week shift in water temperatures that does not allow the river to exhibit a normal thermal regime.*

The proposed change is not just because the current standard is not met. It is because scientific studies support that such a change would be benign for spawning fall Chinook salmon.

Page 2, item 3:

> *...a couple years of high Chinook returns does not indicate that water temperatures are healthy. ... improved run size ..has more to do with the success of the supplementation program. It is not appropriate to develop water temperature standards on the basis of population abundance. Such information is not based on scientific studies of survival under water temperature conditions...*

High population numbers are certainly indicative of a successful population under the current conditions, whether native or supplemented. Supplementation would not have been successful if the habitat, including temperature, hadn't been suitable.

Page 2, item 4:

> *The idea that the temperature standard will achieve 14.5°C for an interim period and then 13°C means only that the rate of temperature decline will not represent the natural rate of decline for at least 3 weeks.*

Again, it is not the exact natural temperature that is an issue, even if that could be defined, but the suitability of the proposed 14.5°C at the time it is proposed. The natural declining-temperature cycle on which Chinook incubation depends is maintained.

Page 2, item 5:

> *IDEQ opens the rulemaking process to all who have an interest in the standard. This is a formula for standard development based on popularity and not scientific merit.*

This appears to be a political statement directed at IDEQ, not a technical one. IPC has provided scientific studies in support of the scientific merit of its proposal.

Page 2, first paragraph under heading:

> [In the "seriously flawed" Geist study, the adults used] *did not have to hold in the high water temperatures ranging up to 22°C or 23°C typical of the migration route to the Hells Canyon Reach. These adults were trapped and returned to hatchery conditions of 12°C* [and spawned at 12°C]. *Consequently, the results are irrelevant to the conditions presented in the Snake River that the fish are actually exposed to.*

Contrary to the statement, the scientific study by Geist (2006) would have been less valuable had the initial holding conditions not been controlled so that the influence of the incubation temperatures could be clearly shown. Introducing variable holding temperatures would have introduced undesirable confounding factors for a well-controlled study. The other studies cited by IPC (the Olson studies) were conducted with fish that had experienced in-river holding prior to the tests, and the results were comparable to those of Geist's 2006 study.

Page 2, bottom paragraph:

> *IPC supplements this study with another questionable study (Olson and Foster 1955)* [which] *spawned test organisms from a single pair of fish. ...With test organisms*

representing only 1 family group, there is no way to tell what the results indicate to the population as a whole.

The 1955 study was clearly presented by the authors as a preliminary study, which was repeated with larger numbers of spawners in subsequent tests summarized by Olson et al. 1970. It is inherent in any exploratory study that not all factors will be included, such as multiple genetic lines. The 2006 Geist study explicitly used different genetic lines.

Page 3, top paragraph:

IPC downplays the results from fish spawned in October [Olson et al. 1970] *and averages away this effect ... and emphasizes the results from the adult spawned in* [colder] *November. ... IDEQ would be making a substantial mistake to direct a standard to apply to the late-arriving fish while allowing the early part of the run to be subject to adverse thermal effects.*

The point that CRITFC does not acknowledge is that the Olson studies (as well as the Geist study) focus on the importance of the early spawning temperatures for subsequent survival during the declining-temperature incubation period. Those studies define the initial spawning temperatures that are suitable, which is the context in which IPC uses them for its proposal. Whether the spawning was in October or November is not as relevant as are the initial incubation temperatures.

Page 3, 2nd paragraph:

The IPC [argues] *that fish to redd ratios are stable enough that there is likely to be little variation in pre-spawning mortality. ... IPC must account for the fact that the Hells Canyon Complex produces a 3-week thermal shift and consequently, it must address the biologic impacts that involve the thermal shift. ... Earlier CRITFC comments showed that there are many potential scenarios in which variation in pre-spawning mortality can be hidden within the observed fish to redd ratios.*

Stable fish-to-redd ratios over years with different thermal regimes for migrating adults would certainly suggest that migrants are not falling away due to thermal mortality before making their redds. That was IPC's point, which seems straightforward. CRITFC's previously stated hypothetical scenarios need to be supported by actual evidence, as IPC has presented for its proposal. The historical thermal shift, which surfaces often in CRITFC's comments, is less important than the actual response of the fish to the temperatures they encounter currently.

Page 3, 3d paragraph:

EPA did not intend for temperature standards to be interpreted as "20°C allowed up to October 23, but with 13°C required after October 23". Such a scenario is not physically feasible. ...Currently, with the HCC thermal shift in place, spawn timing has shifted primarily to after October 23. Fall Chinook...has limits to its biological response and capacity to adapt to changing environmental conditions.

Contrary to CRITFC claim, when a water quality standard changes on a particular date, it does, indeed, mean that one temperature is allowed on one day and the new temperature is allowed on the next day. That is commonly referred to as the "stair step" for water quality regulation. It is difficult to manage in practice, as CRITFC noted, but that is what the regulations require. Smoothing that curve around the 13°C standard on October 23 has been shown satisfactory because of highly successful Chinook spawning when the actual smoothing has gone past October 23. The fish are accommodating quite well to the shift in timing (there is evidence, presented by IPC, that the warmer water at time of spawning and early incubation has benefits for survival over the winter incubation period). Smoothing to the tune of 14.5°C for an additional week after October 23 fits the biological data for successful incubation. There certainly are limits to this accommodation by the fish, but that limit does not seem to have been reached.

Page 3, 4th paragraph:

> *The IPC proposal also ignores the effects of climate change on the Snake River. Restoration of the thermal regime to the Snake River below HCD* [would be advantageous for the fish for several reasons].

A water temperature standard, by definition, ignores climate change or any other changes in the environment. It is a standard for a particular place and time, regardless of whether the surrounding climate is changing. If anything, CRITFC ignores climate change when it presses for restoration of an historical "natural" thermal regime, which may not be relevant in a future of changed climate, regardless of dams.

Pages 3-4, Section on Climate Change:

> *IPC totally ignores the potential impacts of climate change, which is acknowledged by regional climate experts to be significant in the Snake River basin.* [Followed by quotes and citations.]

Climate is certainly changing (whether cyclically or linearly), and the studies cited by CRITFC are valid. But this topic is not directly relevant to a temperature standard at a particular place and time. IPC may have increasing difficulty in meeting that standard as climate warms, but that is not the issue for the IDEQ.

Page 4, bottom paragraph:

> *The IPC proposal downplays the importance of thermal impacts to gamete viability* [from migrating adults in the river] *by a variety of diversionary arguments.*

Loss of gamete viability following exposure of adults to warm temperatures during migration in the Columbia-Snake migration corridor is an interesting issue. As CRITFC indicates, it is not clear for the fall Chinook in the Snake below HCC. But, as I stated in previous comments, CRITFC's disagreement with the current summer temperature standard of 20°C for the mainstem Snake and Columbia migration corridor is a different issue than the one at hand. CRITFC provides quotes later in its comments that show support by NOAA for the 20° mainistem standard.

Page 5, 2nd and 3d paragraphs:

> [S]*ignificant insights* [on the question of gamete viability from the temperature exposure of adults] *have been provided for Atlantic salmon* [citations and data summary].

The King et al. studies do indicate detrimental effects for Atlantic salmon held at 22°C, and CRITFC's logic in extrapolating this to Chinook temperatures during migration seems reasonable. Someone needs to do studies like that for Chinook that pass through the Snake in summer. But the fact remains that this is a different issue than the one before the IDEQ. As I stated before (quoted at top of page 6), the King et al. studies don't support CRITFC's claim in this case that 14.5°C would be detrimental for Chinook in late October. CRITFC's data summary indicates that Atlantic salmon had acceptable gamete survival for adults held at 18°C.

Page 6-8, Coutant quote through end of page 8:

> *In the absence of perfect data, it is reasonable to make inferences from related studies* [about gamete viability from thermally exposed adults] *and to use a precautionary approach. It is also reasonable to consider impacts throughout the life cycle.* [Accompanied by details about the King et al. studies, including abstracts.]

It is a stretch to go from differences in juvenile thermal tolerances between Atlantic salmon and Chinook to differences in tolerances of gametes after exposure of adults to different temperatures. It would be very nice to have studies of this topic for Chinook, especially from the Snake River, but as is, there is only speculation about Chinook. The extrapolation may be logical, and it is helpful to have the information about the King et al. papers, but the issue of the proceeding is not over main stem water quality standards in summer. CRITFC makes no clear linkage between a change from 13°C to 14.5°C for one week in October and summertime exposures to warm temperatures in the downstream rivers.

Page 9, top paragraph:

> *IPC claims that a "one size fits all" standard is not legitimate. The proposal, however, relies on this theory for fall Chinook as a means to impose a one size fits all scenario based on fall Chinook on the Snake River below Hells Canyon dam rather than relying on restoring the natural temperature regime or considering what is best for all downstream salmonids. ...* [M]*aking the current condition the standard is counterproductive to fall Chinook viability.*

It is difficult to understand how a proposed site- and time-specific water quality standard could be described as "a one size fits all scenario" for a water temperature standard, as claimed. The paragraph, however, has multiple topics: protecting the full range of native species, protection of the most sensitive species, the commonality of thermal response by most cold water species, placing in concrete the thermal degradation by the dams, and making the current condition the standard being counterproductive for fall Chinook viability. The paragraph appears self-contradictory and the points unclear

Page 9, second paragraph:

> *Fall Chinook in the Snake River are supported by only one extant population* [because] *Hells Canyon Complex was responsible to causing the extinction of the upriver fall Chinook populations. The future viability of this important population rests more heavily on the current maintenance of high quality waters in the currently used habitat than on* [any upriver restoration and possible dam passage in the future].

Yes, the Chinook population below Hells Canyon Dam is important. There is no issue about the historical loss of upstream populations. The IPC's proposed change in this proceeding would be protective of the existing population, based on available data.

Page 9, 4th paragraph:

> *The idea* [expressed by IPC] *that fall Chinook cannot be compared to other races of Chinook or other species of salmon* [as CRITFC has done in previous comments] *is spurious. IPC has provided no evidence whatsoever that all races of Chinook do not have essentially the same thermal tolerance.*

It is demonstrably risky to assume that all races of Chinook salmon would have the same temperature tolerances, as CRITFC claims. Eliason et al. (2011) showed that even different *tributary populations* of Fraser River sockeye salmon had differences in thermal tolerances (Differences in thermal tolerance among sockeye salmon populations. Science 332:109-112). At least among these sockeye in the Fraser River, differences can be shown at the population level, well below the racial (life-history strategy) level that distinguish spring, summer and fall Chinook salmon. Therefore, it is best to make decisions based on the specific stocks of fish that would be affected, in this case the fall Chinook salmon spawning in the Snake River below the Hells Canyon project (Geist study) or the a geographically close surrogate, the Hanford stock (Olson studies).

Page 9, 5th paragraph:

> *IPC states that fall Chinook "require conditions that promote early emergence to maintain an age-) life history." Maintaining high water temperature until late in October do not* [sic] *promote early spawning and early emergence.*

IPC's statement about conditions that promote early emergence being important for maintaining an age-0 life history is commonly accepted. See: Healey, M. C. 1991. Life history of chinook salmon (*Oncorhynchus tshawytscha*). Pages 311-393 in C. Groot and L. Margolis (editors) Pacific salmon life histories. UBC Press, Vancouver. The "conditions" referred to are the temperature conditions, not date. Connor et al. (2003) specifically evaluated the importance of warm temperature for incubation success of Snake River Chinook salmon (Temperature during incubation as one factor affecting distribution of Snake River fall Chinook salmon spawning areas. Transactions of the American Fisheries Society 132:1236-1243). Early development shortly after spawning that is fostered by relatively warm incubation temperatures has often been identified as influencing the date of emergence.

Page 9, last paragraph (continuing on p. 10):

IPC claims that spawning at temperatures ≤ 16°C is common for fall Chinook. Chinook have occasionally been observed spawning at 19°C, but this does not mean that these temperatures are protective.

It is pretty commonly understood that Chinook salmon spawn at 16°C or less (as IPC "claims"). See Healey above. Since the issue for the proceeding is spawning and early incubation at 14.5°C, the relevance of CRITFC citing 19°C and 16°C is not clear.

Page 10, first full paragraph:

IPC attempts to show that conditions in the Snake River are adequate because they are only slightly worse than found in the Hanford Reach. ... Comparison to other impaired systems is no proof of adequacy of water quality.

The comparison is with a highly successful population at Hanford, which does not exhibit impairment. Historical spawning and successful fry production has been documented at Hanford for over 60 years. The fact that temperature in the Hanford Reach is also influenced by upriver dams and exhibits a 3-week thermal shift from pre-dam conditions, as pointed out by CRITFC, supports the belief that the shift in timing is not critical for population success.

Pages 10-22, Summary of historical NOAA technical and policy position:

NOAA and the USFWS both have a long history of providing official support to 13°C as a protective standard for providing full protection to salmon, including fall Chinook. [Followed by listing of NOAA activities and excerpts from documents]

The relevance of the many citations and quotations from NOAA is not clear for the proceeding at hand. In most cases, NOAA was commenting on broad, regional (usually statewide or tribal-wide) water temperature standards. The proceeding at hand, however, is for application of a site-specific standard, which is allowed under EPA regulations implementing the federal Clean Water Act. The proposal is not only for site specificity, but also for a limited time period, which is also allowed in the EPA regulations. Climate change is not relevant for this proceeding, as commented upon above. Gamete viability under the mainstem thermal standards in summer is not relevant for this proceeding, although in need of further study (as quoted, NOAA supported use of a 20°C migration standard, which CRITFC criticizes). NOAA did, as quoted, allow an implied incidental take at temperatures above 13°C, thus not prohibiting such temperatures. The cited NOAA comments about general thermal degradation, disease, temperature modeling, modifications of critical habitat, research to improve knowledge gaps, and the reservation of right for further consultation are all general issues not specifically related to the proceeding (if CRITFC feels they are relevant, however, they should have annotated their quotations to state the relevance).

Page 13, Item 3, first paragraph:

[Quotation from NOAA letter to EPA, re. Endangered Species Act Section 7 consultation and Magnuson-Stevens Fishery Conservation and Management Act

Essential Fish Habitat Consultation for EPA's evaluation of water temperature standards.]

NOAA notes that most spawning occurs between 4 and 14°C, with optimal incubation temperatures between 4 and 13°C. As most biologists agree, optimal conditions are not synonymous with necessary conditions; many populations of organisms of every kind function under somewhat less than optimal conditions, especially when the conditions experienced are not far from optimal (as IPC's proposed 14.5°C would be) and occur for brief periods (as they would under the proposal by IPC). NOAA is further quoted as indicating that a standard of 16 or 17.5°C would be applicable during the transition about the long-term 13°C standard, even though some embryos will be affected.

Page 15, item (c)(iii):

[Terms and Conditions from quotation above.] *For a water body that is designated "Salmonid spawning, rearing, and migration use" with the applicable temperature criterion (i.e., 17.5° C, 20° C, or 21° C), and where a TMDL, or similar analysis, has been conducted that demonstrates the natural thermal potential of the water body is 16° C or below, the use designation shall be changed to the more appropriate "Core summer salmonid habitat use" ....*

This paragraph, as quoted, appears to sanction temperature criteria of 17.5, 20, or 21°C for salmonid spawning, rearing, and migration use. It requests, however, that an upper temperature of 16 or below would be better, and that streams capable of attaining that temperature should be designated and protected as such. This quotation does not support CRITFC's assertion that an average of 14.5°C for one week would be unacceptable.

Unnumbered page, **Water Temperature Trends**:

Progressive water temperature increases have been observed across the United States [which is] *a major environmental impact that salmon runs have to contend with. ... The ability to accommodate further changes in either maximum temperatures or shifts in thermal regime are limited by the species' behavioral and genetic plasticity (Myrick and Cech .* [sic]

There is no doubt that river temperatures are increasing for a variety of reasons, a fact that IPC does not dispute. Whether from climate change or river damming, this change would not be relevant to the present proceeding, as noted above. The demonstrated success of the Snake River fall Chinook population and also that at Hanford indicates that the species' behavioral and genetic plasticity has not been exceeded by such shifts.

Unnumbered pages, **Thermal Shift in the Columbia River**:

The date on first reaching a water temperature of 16°C was September 28 in 1933-1942, but this was extended to October 19 based on the 1973-1997 record. ... Because salmon cannot successfully spawn until appropriate water temperatures are achieved, the Columbia River fall Chinook would have to adjust their spawn timing or suffer increased mortality in pre-spawning or incubating eggs.

Although not stated in the CRITFC comment, the reason 16°C was selected for comparison of dates was likely because it was the "appropriate water temperature" for initiation of successful spawning. The Hanford Reach spawners have apparently successfully adjusted their spawn timing to maintain a highly successful population in spite of the thermal shift.

Unnumbered pages, **Thermal Shift in the Snake River**:

> *As in the Columbia River example, the date on first reaching a water temperature of 16°C in a declining temperature period (September-October) ... reveals that there is on average a 25-day shift in the timing of passing this temperature.* [Followed by figures and a table documenting the shift]

The same 16°C benchmark is used for the Snake River comparisons. Despite providing evidence for a thermal shift in the Snake River (which has not been denied by IPC) CRITFC has not established the importance of this shift to success of the fall Chinook salmon population below the HCC. Although many potential harmful effects of warmer temperatures are cited, no specific evidence is given that these potential effects are, in fact, occurring below the HCC. Evidence from dozens of papers by W. P. Connor and colleagues in the Snake River below the HCC indicate an abundance of juvenile fall Chinook salmon and many details of incubation, growth and survival under recent temperature regimes. The thermal shift from historical temperatures and present differences in temperatures between Weiser and below HCC are not relevant to whether the fall Chinook population is healthy under recent temperatures below the HCC or the present proceeding.

Unnumbered pages, **Spawn timing**:

> [Discussion that fall Chinook salmon would spawn earlier when temperatures are cooler, as demonstrated by pre-HCC in the Snake River and in the present Clearwater River. Emphasis is on the need to return to the earlier thermal pattern.]

These examples demonstrate the flexibility inherent in fall Chinook salmon to initiate spawning on dates when temperatures are suitable for incubation. Although a "natural seasonal pattern" may seem desirable from human viewpoint (and is necessary in the context of preserving a general seasonal cycle), the salmon are able to adjust their spawning to the physiologically suitable temperatures, within certain bounds. Those bounds apparently have not been exceeded in the Snake River system.

Unnumbered pages, **Natural Seasonal Thermal Pattern (NSTP)**:

> [Continuing discussion of CRITFC's desire to have the Snake River temperatures return to an ill-defined historical temperature, particularly by active temperature management at the HCC. Includes Oregon's definition of a shifted temperature as not natural.] *This shift in the NSTP* [of about 25 days from 1956-1958 temperatures recorded at Central Ferry prior to HCC] *would require that water temperatures be lowered starting about August 1. Also, with the cold water available in Brownlee*

Reservoir, there should be efforts applied to meet the summer water temperature standard.

Active management of water temperatures below the HCC is not part of the present proceeding. As noted above, the fall Chinook salmon population downstream of HCC seems to be reproducing well under the current thermal regime. Detailed laboratory research has shown that initial incubation temperatures above 13°C and even above the requested 14.5°C do not impair successful incubation in a season of declining temperatures. Similar results were shown for Hanford fall Chinook. Thus, there seems to be no biological imperative to meet the 13°C standard by October 23.

Unnumbered page, **Climate Change—Future Trends**:

The probable increases in summertime water temperatures in the Snake River mainstem will necessitate having management tools with near-term effectiveness to control water temperatures. ... A TCS [temperature control system using colder water below the thermocline in Brownlee reservoir] *able to operate from August through October is likely the only means to bring about the correction of the NSTP, reduce summer temperature exceedences, and also meet the fall spawning standard.*

No matter how desirable CRITFC believes a temperature control system using Brownlee cold water might be for reducing summer water temperatures in the mainstem Snake River and meeting spawning temperatures earlier below the HCC, that matter is not a part of the present proceeding. With spawning and incubation apparently doing well under the current thermal regime, including times in October when the 13°C standard is somewhat exceeded, and detailed research providing supporting data, CRITFC has not shown the biological necessity for retaining the 13°C standard for this short period of time in lieu of the IPC proposal.

EXHIBIT:

Resume of Charles C. Coutant, Ph.D.

RESUME

CHARLES C. COUTANT

December 2008

Present Position

Oak Ridge National Laboratory, retired. Private consultant. (October 1, 2005-present)

Born

Jamestown, New York, August 2, 1938

Education

Ph. D.	Lehigh University, Bethlehem, Pennsylvania	Biology 1965
M. S.	Lehigh University, Bethlehem, Pennsylvania	Biology 1962
B. A.	Lehigh University, Bethlehem, Pennsylvania	Biology 1960

Previous Positions

Distinguished Research Ecologist, Environmental Sciences Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831-6036 (2003-2005)

Senior Research Ecologist, Environmental Sciences Division, Oak Ridge National Laboratory, (1982-1985; 1986-1988; 1992-2003)

Manager, ORNL Exploratory Studies Program, Central Management, and Senior Research Ecologist, Oak Ridge National Laboratory (1989-1992)

Manager, DOE Global Carbon Cycle Program, and Senior Research Ecologist, Environmental Sciences Division, Oak Ridge National Laboratory (1985-1986)

Team Leader, Multi-Media Modeling Project and Senior Research Ecologist, Environmental Sciences Division, Oak Ridge National Laboratory (1979-1982)

Manager, Thermal Effects Program, and Research Ecologist, Environmental Sciences Division, Oak Ridge National Laboratory (1970-1979)

Research Scientist, Biology Department (later Ecosystems Department), Battelle-Pacific Northwest Laboratories, Richland, Washington 99352 (1965-1970)

U. S. Public Health Service Predoctoral Fellow, Lehigh University, Bethlehem, Pennsylvania, 18015 (1963-1965)

Professional Societies

American Association for the Advancement of Science (Fellow)
American Institute of Fishery Research Biologists (Fellow)
American Fisheries Society (numerous offices, including President)

American Society for Limnology and Oceanography
American Society for Testing and Materials (lapsed)
Ecological Society of America
Sigma Xi
Water Pollution Control Federation (lapsed)

Professional and Academic Honors

2002	Distinguished Scientist of the Year, UT-Battelle (manager of ORNL)
2001	Distinguished Publication Award, American Society for Information Science (E. TN Chapter)
1999	Scientific Achievement Award, Southern Division, American Fisheries Society
1997	Distinguished Service Award, American Fisheries Society
1996-97	President, American Fisheries Society
1993-1996	Progression from Second Vice Pres., First Vice Pres., Pres. Elect, American Fisheries Society
1993	Elected as Second Vice President, American Fisheries Society
1991-1994	Coeditor, *Transactions of the American Fisheries Society*
1990-1991	President, Oak Ridge Chapter, Sigma Xi
1987-1989	President, Water Quality Section, American Fisheries Society
1987	Distinguished Publication Award, American Society for Information Science
1986-1988	Editorial Board, *Transactions of the American Fisheries Society*
1986-1987	President, Southern Division, American Fisheries Society
1986	President, Tennessee Chapter, American Fisheries Society
1986	Outstanding Publication Award, Martin Marietta Energy Systems, Inc.
1985	Present-Elect, Southern Division, American Fisheries Society
1984	Achievement Award for Excellence in Fisheries, Tennessee Chapter American Fisheries Society
1983	Fellow, American Association for the Advancement of Science
1980	Southeast Regional Lecturer, Sigma Xi
1978-1979	Editorial Board, *Environmental Science and Technology*
1978	Fellow, American Institute for Fishery Research Biologists
1975-1982	Editor, Underwater Telemetry Newsletter
1968	Best Award, Battelle-Northwest, Richland, Washington (Power Plant Siting Study)
1968	Director's Award, Battelle-Northwest (Power Plant Siting Study)
1963	U.S. Public Health Service Predoctoral Fellowship in Water Pollution Control
1963	Darbaker Prize, Pennsylvania Academy of Science (Excellent Microbiology Paper)

Professional Experience

Water Quality

Research and analysis on interactions between water quality and the biological integrity of water, including pollution monitoring and field studies for industry through Lehigh University (graduate assistant) and in private consulting (1960-1965) and annual literature reviews on thermal effects of Water Pollution Control Federation (1967-1978).

Member of National Academy of Sciences Committee on Water Quality, Panel on Freshwater Aquatic Life and Wildlife, and coauthor of the "Blue Book" on water quality, Water Quality Criteria 1972 (National Academy of Sciences/National Academy of Engineering 1973).

American Society for Testing and Materials (ASTM) Task Group Chairman for developing standard practice for evaluating transport/fate models for chemicals in the environment (1981-1984).

Aquatic Ecology and Fisheries

Ph.D. dissertation research on effects of dam discharges on stream ecology; Masters and Postdoctoral research on aquatic macroinvertebrate community responses to pollutants.

Research and analysis on aquatic resources of the middle Columbia River (1965-1970), particularly their responses to thermal effluents. Member, Independent Scientific Advisory Board (previously called the Scientific Review Group and Independent Scientific Group) overseeing the Columbia River Fish and Wildlife Program for Bonneville Power Administration, Northwest Power Planning Council, National Marine Fisheries Service and Columbia River Tribes (1989-2005). Member, Independent Scientific Review Panel for the Northwest Power and Conservation Council (formerly called the Northwest Power Planning Council) for evaluating proposals for the BPA-funded Columbia River Basin Fish and Wildlife Program (1997-2005).

Research and analysis on thermal, entrainment, and impingement effects of thermal power station cooling systems on aquatic organisms, principally fishes.

Thermal ecology of the striped bass (*Morone saxatilis*) and Chinook salmon (*Oncorhynchus tshawytscha*).

Thermal niche partitioning of lakes and estuaries.

Management of power station thermal discharges for environmental benefits.

Introduction of the concept of turbulent attraction flow (simulation of stream turbulence) for guiding migrating fish.

Environmental Impact Assessment

Environmental impact assessments (NEPA EISs) and hearing testimony on impacts of nuclear and fossil-fuel power stations on water quality and aquatic ecology and fisheries for Bonneville Power Administration, Atomic Energy Commission, Nuclear Regulatory Commission, and Department of Energy (Nuclear Power Plant Siting in the Pacific Northwest, Palisades Nuclear Plant, Shoreham Nuclear Plant, Indian Point Nuclear Plant, Kyger Creek Power Plant). Involved aquatic impacts of construction (e.g., dredging) and operation (e.g., thermal, entrainment, impingement, chlorination).

Environmental impact assessments (NEPA EISs) for the Federal Energy Regulatory Commission on two hydroelectric dams in Alaska (Susitna Project), hydropower development in the upper Ohio River basin (cumulative impacts of 19 projects), nine hydropower projects in the Skagit River basin (Washington),

and existing hydropower projects on the Mokelumne and Tuolumne rivers, California. Mentored ORNL staff for other FERC EIS projects.

Project Management

Technical direction and budgetary management for power station cooling systems research and multimedia (air, land, water) modeling projects, each with funding in the $0.5-1 million per year range (1970s dollars), including supervision of up to 20 staff.

Development of a project evaluation process for the Bonneville Power Administration's Columbia River Fish and Wildlife Program.

Management (from ORNL) of the Department of Energy's $4 million/year national research program on environmental determinants of carbon dioxide in the atmosphere as related to $C0_2$-induced global climate change.

Management of Oak Ridge National Laboratory's $8-12 million per year Exploratory Studies Program to support innovative new research ideas.

Advisory Capacity

Research coordination projects, including book preparation, for United Nations Educational, Scientific and Cultural Organization (UNESCO) and International Atomic Energy Agency (IAEA).

Research consultation with governmental agencies: Sweden, Federal Republic of Germany, United Nations Food and Agriculture Organization (FAO), Province of Ontario (Canada), and numerous review boards.

National Advisory Council for Electric Power Research Institute (EPRI).

Regulatory guideline preparation and review for implementation of Section 316(a) of the Clean Water Act for the Environmental Protection Agency (EPA).

Member or chair of several technical advisory committees for resolution of specific energy-environment conflicts.

Program reviewer for USGS Biological Resources Division, USEPA Western Ecology Laboratory (chair), South Carolina Water Department of Natural Resources, NOAA Fisheries' Northwest Fisheries Science Center

Member, Scientific Review Group for Bonneville Power Administration's Columbia River Fish and Wildlife Program.

Member, Independent Scientific Advisory Board for Northwest Power and Conservation Council, National Marine Fisheries Service, and Columbia River Tribes

Member, Independent Scientific Review Panel for Northwest Power and Conservation Council for scientific review of funding proposals to Bonneville Power Administration Fish and Wildlife Program.

Advisor to Environment Canada on thermal effects on aquatic life.

Industrial Technical Assistance

Environmental consulting and testimony for power station environmental impact assessments, including thermal effects studies (Virginia Power Company, Commonwealth Edison Company, Electricity Corporation of New Zealand, Georgia Power Company, Carolina Power & Light Co., Public Service Electric and Gas Co., Pacific Gas and Electric Company, Dynegy, Dominion Power, Vermont Yankee, Southern Nuclear Company), hydropower development (Beak Associates, Puget Power), and water diversions (Sacramento County, California; City of Newport News, Virginia). Author of thermal effects 316(a) Demonstration for Blue Ridge Paper Products. Technical advisor to a stakeholder group evaluating revision of Colorado temperature standards.

Publications

Coutant, C. C. 1962. The effect of a heated water effluent upon the macro-invertebrate riffle fauna of the Delaware River . Proceedings of the Pennsylvania Academy of Science 36: 58-71.

Coutant, C. C. 1963. Steam plankton above and below Green Lane Reservoir. Proceedings of the Pennsylvania Academy of Science 37 :122-126.

Coutant, C. C. 1964. Insecticide Sevin: Effect of aerial spraying on drift of stream insects. Science 146:420-421.

Coutant, C. C. 1966. Bacteria in an impounding reservoir. Journal of the American Water Works Association 58:1275- 1277.

Coutant, C. C. 1966. Positive phototaxis in first instar caddis larvae. pp. 122-123. IN Pacific Northwest Laboratory Annual Report for 1965. BNWL-280. Battelle-Northwest Laboratories, Richland, Washington.

Coutant, C. C. 1967. Biological considerations in water management. pp. 75-84, IN The Use of Simulation in Water Research. Water Resources Research Institute, Oregon State University, Corvallis, Oregon.

Coutant, C. C. 1967. Upstream dispersion of adult caddis flies, pp. 186-187. IN Pacific Northwest Laboratory Annual Report for 1966. BNWL-480, Vol. 1. Battelle-Northwest Laboratories, Richland, Washington.

Coutant, C. C. 1967. Retention of radionuclides in Columbia River bottom organisms. pp. 170-171. IN Pacific Northwest Laboratory Annual Report for 1966. BNWL-480, Vol. 1. Battelle-Northwest Laboratories, Richland, Washington.

Coutant, C. C., D. G. Watson, C. E. Cushing, and W. L. Templeton. 1967. Observations on the life history of the limpet snail *Fisherola nutalli* Haldeman. pp. 190-191. IN Pacific Northwest Laboratory Annual Report for 1966. BNWL-480, Vol. 1. Battelle-Northwest Laboratories, Richland, Washington.

Cushing, C. E., D. G. Watson, R. B. Hall, and C. C. Coutant. 1967. Environmental effects of extended reactor shutdown fish. pp. 71 -75. IN The Environmental Effects of an Extended Hanford Plant Shutdown, BNWL-CC-1056. Battelle-Northwest Laboratories, Richland, Washington.

Harty, H., R. F. Corlett, C. C. Coutant, R. E. Brown, J. F. Fletcher, H. E. Hawthorn, R. T. Jaske, C. L. Simpson, W. L. Templeton, W. A. Watts, M. A. Wolf, J. B. Burnham, J. G. Rake, and G. L. Wilfert. 1967. Final report on nuclear power siting in the Pacific Northwest to Bonneville Power Administration, Portland, Oregon. Battelle-Northwest Laboratories, Richland, Washington. 545 pp.

Watson, D. G., C. E. Cushing, and C. C. Coutant. 1967. Environmental effects of extended reactor shutdown - plankton and invertebrates. pp. 67-70. IN The Environmental Effects of an Extended Hanford Plant Shutdown. BNWL-CC-1056. Battelle-Northwest Laboratories, Richland, Washington.

Watson, D. G., C. E. Cushing, C. C. Coutant, and W. L. Templeton. 1967. Radionuclides in Columbia River organisms. pp. 164-169. IN Pacific Northwest Laboratory Annual Report for 1966. BNWL-480, Vol. 1. Battelle-Northwest Laboratories, Richland, Washington.

Coutant, C. C. 1968. Responses to elevated temperature of fishes near Prescott, Oregon important to the commercial or sport fisheries of the Columbia River. Report to Portland General Electric Company, Portland, Oregon. Battelle-Northwest Laboratories, Richland, Washington.

Coutant, C. C. 1968. Behavior of adult salmon and steelhead trout migrating past Hanford thermal discharges. p. 9.10. IN Pacific Northwest Laboratory Annual Report for 1967. BNWL-714, Vol. 1, Battelle-Northwest Laboratories, Richland, Washington.

Coutant, C. C. 1968. Effect of temperature on the development rate of bottom organisms. p. 9.13. IN Pacific Northwest Laboratory Annual Report for 1967. BNWL-714, Vol. 1. Battelle-Northwest Laboratories, Richland, Washington.

Coutant, C. C. 1968. Thermal pollution - biological effects. A review of the literature of 1967. Journal of the Water Pollution Control Federation 40:1047-1052.

Coutant, C. C., and C. R. Cole. 1968. Modeling of aquatic systems. p. 9.30. IN Pacific Northwest Laboratory Annual Report for 1967. BNWL-714, Vol. 1. Battelle Northwest Laboratories, Richland, Washington.

Coutant, C. C., and C. D. Becker. 1968. Information on timing and abundance of fishes near Prescott, Oregon, important to the commercial and sport fisheries of the Columbia River. Report for the Portland General Electric Company, Portland, Oregon. Battelle Northwest Laboratories, Richland, Washington.

Coutant, C. C., and R. G. Genoway. 1968. An exploratory study of interaction of increased temperature and nitrogen supersaturation on mortality of adult salmonids. Contract No. 12-17-0001-1785. U.S. Bureau of Commercial Fisheries. Battelle-Northwest Laboratories, Richland, Washington.

Coutant, C. C. 1969. Debate on thermal issue continues. Environmental Science and Technology 3(5):425-427.

Coutant, C. C. 1969. Responses of salmonid fishes to acute thermal shock. pp. 2.19-2.26. IN Pacific Northwest Laboratory Annual Report for 1968. BNWL-1050, Vol. 1, Part 2. Battelle-Northwest Laboratories, Richland, Washington.

Coutant, C. C., C. D. Becker, and E. F. Prentice. 1969. Passage of downstream migrants. pp. 2.27-2.30. IN Pacific Northwest Laboratory Annual Report for 1968. BNWL-1050, Vol. 1, Part 2. Battelle-Northwest Laboratories, Richland, Washington.

Coutant, C. C. 1969. Behavior of sonic-tagged chinook salmon and steelhead trout migrating past Hanford thermal discharges. pp. 2.39-2.44. IN Pacific Northwest Laboratory Annual Report for 1968. BNWL-1050, Vol. 1, Part 2. Battelle-Northwest Laboratories, Richland, Washington.

Coutant, C. C. 1969. Temperature, reproduction and behavior. Chesapeake Science 10(3-4):261-274.

Coutant, C. C. 1969. Effects of thermal loading: The Columbia River story. pp. 34-39. IN Nuclear Power and the Environment: An Enquiry. Conservation Society of Southern Vermont, Bondville, Vermont.

Coutant, C. C. 1969. Thermal pollution - biological effects. A review of the literature of 1968. Journal of the Water Pollution Control Federation 41(6): 1036-1053.

Becker, C. D., and C. C. Coutant. 1969. Experimental drifts of juvenile salmonids through effluent discharges at Hanford. Part 1. 1968 Drifts. BNWL-1499. Battelle-Northwest Laboratories, Richland, Washington. 35 pp.

Cushing, C. E., D. G. Watson, C. C. Coutant, and W. L. Templeton. 1969. Effect of Hanford reactor shutdown on Columbia River biota. pp. 291-299. IN Symposium on Radioecology, D. J. Nelson and F. C. Evans (editors). CONF-670503 U.S. Atomic Energy Commission. National Technical Information Service, Springfield, Virginia.

Jaske, R. T., W. L. Templeton, and C. C. Coutant. 1969. Thermal death models. Industrial Water Engineering 6(10):24-27.

Coutant, C. C. 1970. Thermal resistance studies on salmonid fish. pp. 3.19-3.20. IN Pacific Northwest Laboratory Annual Report for 1969. BNWL-1306, Vol. 1, Part 2. Battelle-Northwest Laboratories, Richland, Washington.

Coutant, C. C. 1970. Thermal pollution - biological effects. A review of the literature of 1969. Journal of the Water Pollution Control Federation 42(6):1025- 1057.

Coutant, C. C. 1970. Relative vulnerability of thermally shocked salmonids to predation. p. 3.11. IN Pacific Northwest Laboratory Annual Report for 1969. BNWL-1306, Vol. 1, Part 2. Battelle-Northwest Laboratories, Richland, Washington.

Coutant, C. C. 1970. Thermal resistance of adult coho and jack chinook salmon and steelhead trout from the Columbia River. BNWL-1508. Battelle-Northwest Laboratories, Richland, Washington.

Coutant, C. C. 1970. Behavior of sonic-tagged Chinook salmon and steelhead trout migrating past Hanford thermal discharges (1967). BNWL-1531. Battelle-Northwest Laboratories, Richland, Washington.

Coutant, C. C. 1970. Exploratory studies of the interactions of gas supersaturation and temperature on mortality of juvenile salmonids. BNWL-1529. Battelle Northwest Laboratories, Richland, Washington.

Coutant, C. C. 1970. Biological aspects of thermal pollution. I. Entrainment and discharge canal effects. Critical Reviews in Environmental Control 1(3):341-381.

Coutant, C. C. 1970. Biological limitations on the use of waste heat in aquaculture. pp. 51-61. IN Conf. Beneficial Uses of Thermal Discharges. New York State Dept. of Environmental Conservation, Albany, New York.

Auerbach, S. I., D. J. Nelson, S. V. Kaye, D. E. Reichle, and C. C. Coutant. 1970. Ecological considerations in reactor power plant siting. pp. 804-820. IN Environmental Aspects of Nuclear Power Stations. International Atomic Energy Agency Symposium 146/53, Vienna, Austria.

Coutant, C. C., and C. D. Becker. 1970. Growth of Columbia River limpets, *Fisherola nuttalli* (Haldeman), in normal and reactor-warmed water. BNWL-1537. Battelle Northwest Laboratories, Richland, Washington. 12 pp.

Coutant, C. C., J. M. Dean, and C. R. Cole. 1970. Modeling thermal death of fishes in fluctuating lethal temperatures. pp. 3.9-3.11. IN Pacific Northwest Laboratory Annual Report for 1969. BNWL-1306, Vol. 1, Part 2. Battelle Northwest Laboratories, Richland, Washington.

Becker, C. D., C. C. Coutant, and E. F. Prentice. 1970. Plume drifts with juvenile salmon. pp. 3.18-3.19. IN Pacific Northwest Laboratory Annual Report for 1969. BNWL-1306, Vol. 1, Part 2. Battelle-Northwest Laboratories, Richland, Washington.

Jaske, R. T., W. L. Templeton, and C. C. Coutant. 1970. Methods of evaluating effects of transient conditions in heavily loaded and extensively regulated streams. Chemical Engineering Progress Symposium Series 67(107):31-39.

Nelson, J. L., V. Bruns, C. C. Coutant, and R. Carlile. 1970. Behavior and reactions of copper sulfate in an irrigation canal. Pesticide Monitoring Journal 3(3):186.

Templeton, W. L., and C. C. Coutant. 1970. Studies on the biological effects of thermal discharges from nuclear reactors to the Columbia River at Hanford. pp. 491-614. IN Environmental Aspects of Nuclear Power Stations. International Atomic Energy Agency Symposium 146/53, Vienna, Austria.

Watson, D. G., C. E. Cushing, C. C. Coutant, and W. L. Templeton. 1970. Radioecological Studies on the Columbia River, Parts I and II. BNWL-1377. Battelle-Northwest Laboratories, Richland, Washington. 46 pp. + appendices.

Coutant, C. C. 1971. Thermal pollution - biological effects. Journal of the Water Pollution Control Federation 43(6):1292-1334.

Coutant, C. C. 1971. Effects on organisms of entrainment in cooling water: Steps toward predictability. Nuclear Safety 12(6):600-607.

Coutant, C. C. 1971. Great Lakes ecology. pp. 93-123, IN F. A. Butrico, C. J. Touhill, and I. L. Whitman (editors), Resource Management in the Great Lakes Basin. Heath Lexington Books, Lexington, Massachusetts.

Becker, C. D., and C. C. Coutant. 1971. Bionomics of Columbia River limpets in normal and reactor-warmed water. pp. 2.27-2.28. IN Pacific Northwest Laboratory Annual Report for 1970. BNWL-1550, Vol. 1, Part 2. Battelle-Northwest Laboratories, Richland, Washington.

Becker, C. D., C. C. Coutant, and E. F. Prentice. 1971. Experimental drifts of juvenile salmonids through effluent discharges at Hanford. Part II. 1969 drifts and conclusions. BNWL-1527. Battelle-Northwest Laboratories. Richland, Washington. 61 pp.

Templeton, W. L., and C. C. Coutant. 1971. A Bibliography of Ecological Publications Supported by the U.S. Atomic Energy Commission Related to Columbia River Thermal Effects Studies. BNWL-1543. Battelle-Northwest Laboratories, Richland, Washington.

Watson, D. G., C. E. Cushing, C. C. Coutant, and W. L. Templeton. 1971. Cycling of radionuclides in Columbia River biota. pp. 144-157. IN D. D. Hemphill (editor), Trace Substances in Environmental Health - IV. University of Missouri, Columbia, Missouri.

Coutant, C. C. 1972. Index for annual reviews 1967-1970. Thermal pollution-biological effects. ORNL/EIS-71/25. Oak Ridge National Laboratory, Oak Ridge, Tennessee. 120 pp.

Coutant, C. C. 1972. Successful cold branding of nonsalmonids. Progressive Fish-Culturist 34(3):131-132.

Coutant, C. C. 1972. Ecological effects of power plant cooling. Interdisciplinary Seminar for the Water Resources Development Program. Report No. 17:23-44. Water Resources Research Center, The University of Tennessee, Knoxville, Tennessee.

Coutant, C. C. 1972. Effect of thermal shock on vulnerability to predation in juvenile salmonids, I. Single shock temperature. BNWL-1521. Battelle-Northwest Laboratories, Richland, Washington.

Coutant, C. C. 1972. Effect of thermal shock on vulnerability to predation in juvenile salmonids, II. A dose response by rainbow trout to three shock temperatures. BNWL-1519. Battelle-Northwest Laboratories, Richland, Washington.

Coutant, C. C. 1972. Biological aspects of thermal pollution. II. Scientific basis for water temperature standards at power plants. Critical Reviews in Environmental Control 3(1):1-24.

Coutant, C. C. 1972. Some biological considerations for the use of power plant cooling water in aquaculture. pp. 104-113. IN J. L. Gaudet (editor), Report of the 1970 Workshop on Fish Feed Technology and Nutrition. U.S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife, Resource Publication 102. Superintendent of Documents, Washington, D.C.

Coutant, C. C., and J. M. Dean. 1972. Relationships between equilibrium loss and death as responses of juvenile chinook salmon and rainbow trout to acute thermal shock. BNWL-1520. Battelle-Northwest Laboratories, Richland, Washington.

Coutant, C. C., and C. P. Goodyear. 1972. Thermal effects. Journal of the Water Pollution Control Federation 44(6):1250-1294.

Coutant, C. C., E. E. Huber, and H. A. Pfuderer. 1972. Thermal effects on aquatic organisms: Annotated bibliography of 1971 literature. ORNL/EIS-72/28. Oak Ridge National Laboratory, Oak Ridge, Tennessee. 155 pp.

Mattice, J. S., and C. C. Coutant. 1972. AIF topical conference on water quality problems. Nuclear News 15(11):122-126.

Coutant, C. C. 1973. Effect of thermal shock on vulnerability of juvenile salmonids to predation. Journal of the Fisheries Research Board of Canada 30:965-973.

Coutant, C. C. 1973. Heat and temperature. pp. 151-171. IN Water Quality Criteria 1972. Environmental Studies Board, National Academy of Sciences/National Academy of Engineering. U.S. Environmental Protection Agency, EPA.R3.73.033. Washington, D.C.

Becker, C. D., C. C. Coutant, and E. F. Prentice. 1973. Ecological evaluation: Migration of juvenile salmon in relation to heated effluents in the central Columbia River. pp. 528-536. IN D. J. Nelson (editor), Radionuclides in Ecosystems. Third National Symposium on Radioecology. CONF-710501 U.S. Atomic Energy Commission. National Technical Information Service, Springfield, Virginia. 1268 pp.

Bowen, S. H., and C. C. Coutant. 1973. Thermal effect on feeding competition between rainbow trout and bluegill. pp. 1029-1033. IN D. J. Nelson (editor), Radionuclides in Ecosystems. Third National Symposium on Radioecology. CONF-710501 U.S. Atomic Energy Commission. National Technical Information Service, Springfield, Virginia.

Coutant, C. C., and C. D. Becker. 1973. Growth of the Columbia River limpet, *Fisherola nutalli* (Haldeman), in normal and reactor-warmed water. pp. 564-568. IN D. J. Nelson (editor), Radionuclides in Ecosystems. Third National Symposium on Radioecology. CONF-710501 U.S. Atomic Energy Commission. National Technical Information Service, Springfield, Virginia. 1268 pp.

Coutant, C. C., and H. A. Pfuderer. 1973. Thermal effects on aquatic organisms. ORNL/EIS-73/28. Oak Ridge National Laboratory, Oak Ridge, Tennessee. 183 pp.

Coutant, C. C., and H. A. Pfuderer. 1973. Thermal effects. Journal of the Water Pollution Control Federation 45(6):1331-1369.

Rochelle, J. M., and C. C. Coutant. 1973. Temperature sensitive ultrasonic fish tag, Q-5099. ORNL/TM-4438. Oak Ridge National Laboratory, Oak Ridge, Tennessee. 26 pp.

Coutant, C. C. 1974. Physiology for the fishery ecologist. Ecology 55(3):686-687.

Coutant, C. C., H. M. Ducharme, Jr., and J. R. Fisher. 1974. Effects of cold shock on vulnerability of juvenile channel catfish (*Ictalurus punctatus*) and largemouth bass (*Micropterus salmoides*) to predation. Journal of the Fisheries Research Board of Canada 31(3):351-354.

Coutant, C. C., and H. A. Pfuderer. 1974. Thermal effects. Journal of the Fisheries Research Board of Canada 46(6):1476-1540.

Coutant, C. C., H. A. Pfuderer, and B. N. Collier. 1974. Thermal effects on aquatic organisms: An annotated bibliography of 1973 literature. ORNL/EIS-74/28. Oak Ridge National Laboratory, Oak Ridge, Tennessee. 241 pp.

Goodyear, C. P., C. C. Coutant, and J. R. Trabalka. 1974. Sources of potential biological damage from once-through cooling systems of nuclear power plants. ORNL/TM-4180. Oak Ridge National Laboratory, Oak Ridge, Tennessee. 43 pp.

Rochelle, J. M., and C. C. Coutant. 1974. Ultrasonic tag for extended temperature monitoring from small fish. Underwater Telemetry Newsletter 4(1):1, 4-7.

Coutant, C. C. 1975. Responses of bass to natural and artificial temperature regimes. pp. 272-285. IN R. H. Stroud and H. Clepper (editors), Black Bass Biology and Management. Sport Fishing Institute, Washington, D.C.

Coutant, C. C. 1975. Temperature and organisms. Ecology 56(2):499.

Coutant, C. C. 1975. Evaluation of entrainment effect. pp. 1-10. IN L. D. Jensen (editor), 2nd Entrainment and Intake Screening Workshop. The Johns Hopkins University Water Research Project Report No. 15. Baltimore, Maryland.

Coutant, C. C. 1975. Temperature selection by fish -- A factor in power-plant impact assessments. pp. 575-597. IN Environmental Effects of Cooling Systems at Nuclear Power Plants. IAEA-SM-187/11. International Atomic Energy Agency, Vienna, Austria.

Coutant, C. C. 1975. Effects of power plants (book review). Science 189:132-133.

Coutant, C. C., and R. J. Kedl. 1975. Survival of larval striped bass exposed to fluid-induced and thermal stresses in a simulated condenser tube. ORNL/TM-4695. Oak Ridge National Laboratory, Oak Ridge, Tennessee. 37 pp.

Coutant, C. C., and S. S. Talmage. 1975. Thermal effects: A review of the literature of 1974 on wastewater and water pollution control. Journal of the Water Pollution Control Federation 47(6):1656-1711.

Coutant, C. C., S. S. Talmage, R. F. Carrier, and B. N. Collier. 1975. Thermal effects on aquatic organisms -- Annotated bibliography of the 1974 literature. ORNL/EIS-75/28. Oak Ridge National Laboratory, Oak Ridge, Tennessee. 168 pp.

Coutant, C. C. 1976. Physical and ecological consequences of power plant cooling. Working draft paper for UNESCO International Hydrological Programme - Man and the Biosphere Working Group Meeting, Paris. 23-26 March 1976.

Coutant, C. C. 1976. Syntheses of recommendations. pp. 23-34. IN Sigma Research, Inc. (editor), Workshop on the Impact of Thermal Power Plant Cooling Systems on Aquatic Environments. Special Report 38, Vol. I. Working Group Results. Electric Power Research Institute, Palo Alto, California.

Coutant, C. C. 1976. Impact of power plants on aquatic systems: A social perspective. pp. 14-20. IN Sigma Research, Inc. (editor), Workshop on the Impact of Thermal Power Plant Cooling Systems on Aquatic Environments. Special Report No. 38, Vol. II. Electric Power Research Institute, Palo Alto, California.

Coutant, C. C. 1976. Thermal effects on fish ecology. pp. 891-896. IN Encyclopedia of Environmental Engineering, Volume 2. W & G. Baird, Ltd., Northern Ireland.

Coutant, C. C. 1976. How to put waste heat to work. Environmental Science and Technology 10(9):868-871.

Bowles, R. R., C. C. Coutant, and J. S. Griffith. 1976. Effects of water velocity on activity of juvenile striped bass. ORNL/TM-5368. Oak Ridge National Laboratory, Oak Ridge, Tennessee. 73 pp.

Coutant, C. C., and D. K. Cox. 1976. Growth rates of subadult largemouth bass at 24 to 35.5°C. pp. 118-120. IN G. W. Esch and R. W. McFarlane (editors), Thermal Ecology II. CONF-750425 U. S. Atomic Energy Commission. National Technical Information Service, Springfield, Virginia.

Coutant, C. C., and S. S. Talmage. 1976. Thermal effects. Journal of the Water Pollution Control Federation 48(6):1487-1544.

Coutant, C. C., S. S. Talmage, R. F. Carier, B. N. Collier, and N. S. Dailey. 1976. Thermal effects on aquatic organisms. Annotated bibliography of the 1975 literature. ORNL/EIS-88, Oak Ridge National Laboratory, Oak Ridge, Tennessee. 323 pp.

Coutant, C. C., D. K. Cox, and K. W. Moored, Jr. 1976. Further studies of cold shock effects on susceptibility of young channel catfish to predation. pp. 154-158. IN G. W. Esch and R. W. McFarlane (editors), Thermal Ecology II. CONF-750425 U. S. Atomic Energy Commission. National Technical Information Service, Springfield, Virginia.

Cox, D. K., and C. C. Coutant. 1976. Acute cold-shock resistance of gizzard shad. pp. 159-161. IN G. W. Esch and R. W. McFarlane (editors), Thermal Ecology II. CONF-750425 U. S. Atomic Energy Commission. National Technical Information Service, Springfield, Virginia.

Kedl, R. J., and C. C. Coutant. 1976. Survival of juvenile fishes receiving thermal and mechanical stresses in a simulated power plant condenser. pp. 394-400. IN G. W. Esch and R. W. McFarlane (editors),

Thermal Ecology II. CONF-750425 U. S. Atomic Energy Commission. National Technical Information Service, Springfield, Virginia.

Wolters, W. R., and C. C. Coutant. 1976. The effect of cold shock on the vulnerability of young bluegill (*Lepomis macrochirus*) to predation. pp. 162-164. IN G. W. Esch and R. W. McFarlane (editors), Thermal Ecology II. CONF-750425 U. S. Atomic Energy Commission. National Technical Information Service, Springfield, Virginia.

Coutant, C. C. 1977. Representative species concept. pp. 149-154. IN R. K. Ballentine and L. J. Guawaia (editors), The Integrity of Water. U. S. Environmental Protection Agency, Washington, D.C.

Coutant, C. C. 1977. Physiological considerations of future thermal additions for aquatic life. pp. 251-266. IN M. Marois (editor), World Conference Towards a Plan of Actions for Mankind, Volume 3, Biological Balance and Thermal Modifications. Pergamon Press, Oxford.

Coutant, C. C. 1977. Ecological successes of the freshwater black basses (book review). Ecology 58(1):218.

Coutant, C. C. 1977. The Connecticut River ecological study: The impact of a nuclear power plant (book review). Transactions of the American Fisheries Society 106(1): 115-116.

Coutant, C. C. 1977. Cold shock to aquatic organisms - Guidance for power plant siting, design, and operation. Nuclear Safety 18(3):329-342.

Coutant, C. C. 1977. Compilation of temperature preference data. Journal of the Fisheries Research Board of Canada 34:739-745.

Beall, S. E., C. C. Coutant, M. Olszewski, and J. S. Suffern. 1977. Energy from cooling water. Industrial Water Engineering 14(6):8-14.

Coutant, C. C., and S. S. Talmage. 1977. Thermal effects. Journal of the Water Pollution Control Federation 49(6):1369-1425.

Stevens, A. R., R. L. Tyndall, C. C. Coutant, and E. Willaert. 1977. Isolation of the etiologic agent of primary amoebic meningoencephalitis from artificially heated waters. Journal of Applied Environmental Microbiology 34(6): 701-705.

Coutant, C. C. 1978. Determining the ecological effects of power plant cooling. pp. 173-200. IN Fifth FAO/SIDA Workshop on Aquatic Pollution in Relation to Living Resources. TF-RAS 34 (SWE), Suppl. 1. Food and Agricultural Organization of the United Nations, Rome, Italy.

Coutant, C. C. 1978. A working hypothesis to explain mortalities of striped bass, *Morone saxatilis*, in Cherokee Reservoir. ORNL/TM-6534. Oak Ridge National Laboratory, Oak Ridge, Tennessee. 36 pp.

Coutant, C. C., C. S. Wasserman, M. S. Chung, D. B. Rubin, and M. Manning. 1978. Chemistry and biological hazard of a coal ash seepage stream. Journal of the Water Pollution Control Federation 50(4):747-753.

Olszewski, M., J. S. Suffern, C. C. Coutant, and D. K. Cox. 1979. An overview of waste heat utilization research at the Oak Ridge National Laboratory. pp. 2299-2320. IN S. S. Lee and S. Sengupta (editors), Waste Heat Management and Utilization. Hemisphere Publishing Corporation, Washington, D.C.

Schubel, J. R., C. C. Coutant, and P. M. J. Woodhead. 1978. Thermal effects of entrainment. pp. 19-93. IN J. R. Schubel and B. C. Marcy (editors), Power Plant Entrainment. A Biological Assessment. Academic Press, New York, New York.

Suffern, J. S., S. M. Adams, B. G. Blaylock, C. C. Coutant, and C. A. Guthrie. 1978. Growth of monosex hybrid Tilapia in the laboratory and sewage oxidations ponds. pp. 65-82. IN Symposium on Culture of Exotic Fishes. Fish Culture Society, American Fisheries Society, Auburn, Alabama. 257 pp.

Talmage, S. S., and C. C. Coutant. 1978. Thermal effects. Journal of the Water Pollution Control Federation 50(6):1514-1553.

Tyndall, R. L., E. Willaert, A. R. Stevens, and C. C. Coutant. 1978. Isolation of pathogenic *Naegleria* from artificially heated waters. pp. 117-123. IN Symposium on Microbiology of Power Plant Thermal Effluents. University of Iowa Press, Iowa City, Iowa.

Coutant, C. C. 1979. Count kilowatts for fun, profit. Nuclear Division News (Union Carbide Corporation) 10(13):3,81.

Coutant, C. C., R. B. McLean, and D. L. DeAngelis. 1979. Influence of physical and chemical alterations on predator-prey interactions. pp. 57-68. IN R. H. Stroud and H. Clepper (editors), Predator-Prey Systems in Fisheries Management. Sport Fishing Institute, Washington, D.C.

Coutant, C. C., D. S. Vaughan, and H. McLain. 1979. Scientific review, analysis and critique of section 316(a) thermal demonstrations and section 316(b) intake demonstrations. For Public Service of Indiana, Cayuga and Wabash Generating Stations. Oak Ridge National Laboratory, Oak Ridge, Tennessee for U.S. Environmental Protection Agency, Region V, Chicago, Illinois. 38 pp.

Coutant, C. C., and J. S. Suffern. 1979. Temperature influences on growth of aquatic organisms. pp. 113-124. IN S. S. Lee and S. Sengupta (editors), Waste Heat Management and Utilization. Hemisphere Publishing Corp., Washington, D.C.

DeAngelis, D. L., and C. C. Coutant. 1979. Growth rates and size distributions of first-year smallmouth bass populations: Some conclusions from experiments and a model. Transactions of the American Fisheries Society 108:137-141

DeAngelis, D. L., D. K. Cox, and C. C. Coutant. 1979. Cannibalism and size dispersal in young-of-the-year largemouth bass: Experiment and model. Ecological Modelling 8:133-148.

Majewski, W., D. C. Miller, and C. C. Coutant. 1979. Chapter I. Introduction. pp. 13-19. IN W. Majewski and D. C. Miller (editors), Predicting Effects of Power Plant Once-through Cooling on Aquatic Systems. Technical Papers in Hydrology 10, UNESCO, Paris, France .

Miller, D. C., and C. C. Coutant. 1979. Chapter II. Potential and observed ecological effects of once-through cooling systems. pp. 20-52. IN W. Majewski and D. C. Miller (editors), Predicting Effects of Power Plant Once-through Cooling on Aquatic Systems. Technical Papers in Hydrology 10, UNESCO, Paris, France.

Coutant, C. C. 1979. Chapter III. A conceptual format for cooling system environmental impact assessment projects. pp. 53-67. IN W. Majewski and D. C. Miller (editors), Predicting Effects of Power Plant Once-through Cooling on Aquatic Systems. Technical Papers in Hydrology 10, UNESCO, Paris, France.

Miller, D. C., and C. C. Coutant. 1979. Chapter VII. Preoperational cooling system impact assessment: Physical and biological information requirements. pp. 118-136. IN W. Majewski and D. C. Miller (editors), Predicting Effects of Power Plant Once-through Cooling on Aquatic Systems. Technical Papers in Hydrology 10, UNESCO, Paris, France.

Miller, D. C., and C. C. Coutant. 1979. Chapter VIII. Operational monitoring of cooling system impacts. pp. 137-145. IN W. Majewski and D. C. Miller (editors), Predicting Effects of Power Plant Once-through Cooling on Aquatic Systems. Technical Papers in Hydrology 10, UNESCO, Paris, France.

Coutant, C. C. 1979. Chapter IX. Beneficial uses of discharge heat. pp. 146-155. IN W. Majewski and D. C. Miller (editors), Predicting Effects of Power Plant Once-through Cooling on Aquatic Systems. Technical Papers in Hydrology 10, UNESCO, Paris, France.

Talmage, S. S., and C. C. Coutant. 1979. Thermal effects. Journal of the Water Pollution Control Federation 51(6) :1517-1554.

Coutant, C. C. 1980. Critical choices: Energy conservation in power plant cooling. pp. 188-190. IN Environmental Effects of Cooling Systems, Technical Reports Series No. 202, International Atomic Energy Agency, Vienna, Austria.

Coutant, C. C. 1980. Adaptation capability. pp. 134-141. IN Environmental Effects of Cooling Systems. Technical Reports Series No . 202 . International Atomic Energy Agency, Vienna, Austria.

Coutant, C. C. 1980. Pathogenic amoeba. pp. 121-124. IN Environmental Effects of Cooling Systems. Technical Reports Series No. 202, International Atomic Energy Agency, Vienna, Austria.

Coutant, C. C. 1980. Beneficial uses of reject heat. pp. 190-192. IN Environmental Effects of Cooling Systems. Technical Reports Series No. 202, International Atomic Energy Agency, Vienna, Austria.

Coutant, C. C. 1980. Abortive tagging makes sense. Underwater Telemetry Newsletter 10(1) :13.

Coutant, C. C. 1980. Environmental quality for striped bass. pp. 179-187. IN H. Clepper (editor), Marine Recreational Fisheries 5, Sport Fishing Institute, Washington, D.C.

Coutant, C. C., and D. S. Carroll. 1980. Temperatures occupied by ten ultrasonic-tagged striped bass in freshwater lakes. Transactions of the American Fisheries Society 109: 195-202 .

Coutant, C. C., H. R. Waddle, and B. A. Schaich. 1980. Temperature and habitat selection by striped bass. Underwater Telemetry Newsletter 10(1):1, 3 -4 .

Schaich, B. A., and C. C. Coutant. 1980. A biotelemetry study of spring and summer habitat selection by striped bass in Cherokee Reservoir, Tennessee, 1978. ORNL/TM-7127. Oak Ridge National Laboratory, Oak Ridge, Tennessee. 226 pp.

Spigarelli, S., and C. C. Coutant. 1980. Ecosystem stress and cooling systems. pp. 175-184. IN Environmental Effects of Cooling Systems, Technical Reports Series No. 202, International Atomic Energy Agency, Vienna, Austria.

Talmage, S. S., and C. C. Coutant. 1980. Thermal effects. Journal of the Water Pollution Control Federation 52(6) :1575-1615.

Van Winkle, W., C. C. Coutant, J. W. Elwood, S. G. Hildebrand, J. S. Mattice, and R. B. McLean. 1980. Comparative reservoir research at Oak Ridge National Laboratory. pp. 1432-1447. IN Symposium on Surface Water Impoundments. Paper No. 7-23. American Society of Civil Engineers, Minneapolis, Minnesota.

Waddle, H. R., C. C. Coutant, and J. L. Wilson. 1980. Summer habitat selection by striped bass, *Morone saxatilis*, in Cherokee Reservoir, Tennessee, 1977. ORNL/TM-6927. Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Coutant, C. C. 1981. Foreseeable effects of C02-induced climate change: Freshwater concerns. Environmental Conservation 8(4):285-297.

Cox, D. K., and C. C. Coutant. 1981. Growth dynamics of juvenile striped bass as functions of temperature and ration. Transactions of the American Fisheries Society 110:226-238.

Coutant, C. C. 1982. Effects of C02-induced climate change on freshwater ecosystems. IN Report by American Association for the Advancement of Science on the C02 Problem. U.S. Department of Energy, Washington, D.C.

Coutant, C. C. 1982. Evidence for upstream dispersion of adult caddisflies (Trichoptera:Hydropsychidae) in the Columbia River. Aquatic Insects 4(2):61-66.

Coutant, C. C. 1982. Positive phototaxis in first instar *Hydropsyche cockerelli* Banks. Aquatic Insects 4(1):55-59.

Conway, L., G. Chapman, C. C. Coutant, E. Crecelius, B. Jaslow, L. Thorne, and R. Vocke. 1982. Environmental mobility of toxic substances released from photovoltaic-associated processes: Aquatic systems. pp. 139-161. IN G. R. Hendrey, P. D. Maskowitz, D. Patten, W. Berry, and H. L. Conway (editors), Potential Environmental Problems of Photovoltaic Energy Technology. BNL-51431, Brookhaven National Laboratory, Upton, New York.

DeAngelis, D. L., and C. C. Coutant. 1982. Genesis of bimodal size distributions in species cohorts. Transactions of the American Fisheries Society 111:384-388.

Coutant, C. C. 1983. Striped bass and the management of cooling lakes. pp. 389-396. IN S. S. Lee and S. Sengupta (editors), Waste Heat Utilization and Management. Hemisphere Publishing Corp., Washington, D.C.

Cheek, T. E., M. J. Van den Avyle, and C. C. Coutant. 1983. Distribution and habitat selection of adult striped bass, *Morone saxatilis* (Walbaum), in Watts Bar Reservoir, Tennessee. ORNL/TM-8447. Oak Ridge National Laboratory, Oak Ridge, Tennessee. 288 pp.

Coutant, C. C. 1983. Thermal pollution by power plants. pp. 846-868. IN Encyclopedia of Chemical Technology. Vol. 22, Third Edition. John Wiley & Sons, Inc., New York.

Coutant, C. C., and D. L. DeAngelis. 1983. Comparative temperature-dependent growth rates of largemouth and smallmouth bass fry. Transactions of the American Fisheries Society 112:416-423.

Coutant, C. C., and W. Van Winkle. 1983. Paradox of the striped bass: ORNL fishes for answers. ORNL Review 16(3):2-10. Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Wetzel, R. G., J. B. Grace, E. A. D. Allen, J. W. Barko, S. Beer, G. Bowes, M. Briston, C. C. Coutant, B. G. Drake, J. E. Hobble, O. Holm-Hanse, H. B. A. Prins, and J. H. Peverley. 1983. Aquatic plant communities. pp. 223-280. IN E. R. Lemon, (editor) C02 and Plants: The Response of Plants to Rising Levels of Atmospheric Carbon Dioxide. AAAS Symp. No. 84. Westview Press, Boulder, Colorado.

Coutant, C. C., K. L. Zachmann, D. K. Cox, and B. L. Pearman. 1984. Temperature selection by juvenile striped bass in laboratory and field. Transactions of the American Fisheries Society 113:666-671.

Patterson, M. R., R. J. Sworski, A. L. Sjoreen, M. G. Browman, C. C. Coutant, D. M. Hetrick, B. D. Murphy, R. J. Raridon. 1984. A user's manual for UTM-TOX, the Unified Transport Model. ORNL-6064. Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Weller, D. E., D. J. Anderson, D. L. DeAngelis, and C. C. Coutant. 1984. Rates of heat exchange in largemouth bass: Experiment and model. Physiological Zoology 57:413-427.

Coutant, C. C. 1985. Striped bass, temperature, and dissolved oxygen: A speculative hypothesis for environmental risk. Transactions of the American Fisheries Society 114(1):31-61.

Coutant, C. C. 1985. Striped bass: Environmental risks in fresh and salt water. Transactions of the American Fisheries Society 114:1-2.

Cheek, T. E., M. J. Van den Avyle, and C. C. Coutant. 1985. Influences of water quality on distribution of striped bass in a Tennessee River impoundment. Transactions of the American Fisheries Society 114(1):67-76.

Coutant, C. C., and G. F. Cada. 1985. Analysis and development of a project evaluation process. Bonneville Power Administration, DOE/BP-391, Portland, Oregon.

Coutant, C. C. 1986. Thermal niches of striped bass. Scientific American 254(8):98-104.

Coutant, C. C. 1987. Thermal preference: When does an asset become a liability? Environmental Biology of Fishes 18(3) :161-172.

Coutant, C. C. 1987. Poor reproductive success of striped bass from a reservoir with reduced summer habitat. Transactions of the American Fisheries Society 116(2):154-160.

Coutant, C. C., and D. L. Benson. 1988. Linking estuarine water quality and impacts on living resources: Shrinking striped bass habitat in Chesapeake Bay and Albermarle Sound. U.S. Environmental Protection Agency, EPA 503/3-88-001, Washington, D.C.

Coutant, C. C., and C. L. Heckman. 1988. A review of state regulations that exceed those of the Federal Resource Conservation and Recovery Act (RCRA). DOE/HWP-40, Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Sale, M. J., S. F. Railsback, S. Y. Chang, C. C. Coutant, R. E. Spath, and G. H. Taylor. 1989. Balancing hydropower development in thc Ohio River basin. pp. 886-896 in A. J. Eberhardt (editor), Proceedings of an International Conference on Hydropower. American Society of Civil Engineers, New York.

Coutant, C. C. 1990. Temperature-oxygen habitat for freshwater and coastal striped bass in a changing climate. Transactions of the American Fisheries Society 119:240-253.

Railsback, S. F., C. C. Coutant, and M. J. Sale. 1990. Improving the effectiveness of fisheries agencies in developing hydropower mitigation. Fisheries (Bethesda) 15:3-8.

Coutant, C. C., and D. L. Benson. 1990. Summer habitat suitability for striped bass in Chesapeake Bay: reflections on a population decline. Transactions of the American Fisheries Society 119:757-778.

Coutant, C. C. 1990. Microchemical analysis of fish hard parts for reconstructing habitat use: Practice and promise. American Fisheries Society Symposium 7:574-580.

Coutant, C. C. 1992. Testing the Waters. Electric Perspectives 16(4):32-40.

Coutant, C. C., and C. H. Chen. 1993. Strontium microstructure in scales of freshwater and estuarine striped bass (*Morone saxatilis*) detected by laser ablation mass spectrometry. Canadian Journal of Fisheries and Aquatic Sciences 50: 1318-1323.

Rose, K. A., J. H. Cowan, jr., E. D. Houde, and C. C. Coutant. 1993. Individual-based modeling of environmental quality effects on early life stages of fishes: a case study using striped bass. American Fisheries Society Symposium 14:125-145.

Sale, M. J., and C. C. Coutant. 1994. Hydropower: licensed to protect the environment (edited interview). ORNL Review 26(3/4):2-19.

Coutant, C. C., T. W. H. Backman, G. R. Bouck, E. M. Dawley, L. E. Fidler, and W. Krise. 1994. Panel on Gas Bubble Disease. Working Group Meeting June 21-22, 1994. National Marine Fisheries Service, Northwest Fisheries Science Center, Seattle, Washington.

Coutant, C. C., T. W. H. Backman, E. M. Dawley, W. J. Ebel, L. E. Fidler, A. Nebeker, and R. G. White. 1995. Panel on Gas Bubble Disease. Second Working Group Meeting November 1-3, 1994. National Marine Fisheries Service, Northwest Fisheries Science Center, Seattle, Washington.

Coutant, C. C. 1995. Thermal Pollution, Power Plants. Pages 2607-2620. IN: Encyclopedia of Energy Technology and the Environment, John Wiley & Sons, New York.

Coutant, C. C., T. W. H. Backman, G. R. Bouck, E. M. Dawley, W. J. Ebel, L. E. Fidler, J. O. T. Jensen, W. Krise, and R. G. White. 1996. Summary Report. Panel on Gas Bubble Disease. Third Working Group Meeting February 1-3, 1996. National Marine Fisheries Service, Northwest Fisheries Science Center, Seattle, Washington.

Coutant, C. C. 1996. Comment: Effects of instream brush on juvenile coho salmon. Transactions of the American Fisheries Society 125:150-151.

Stanford, J. A., J. V. Ward, W. J. Liss, C. A. Frissell, R. N. Williams, J. A. Lichatowich, and C. C. Coutant. 1996. A general protocol for restoration of regulated rivers. Regulated Rivers: Research and Management 12:391-413.

Dickerman, J., and C. C. Coutant. 1996. Oceans, energy, and environmental policy: a primer. Oak Ridge National Laboratory for U. S. Department of Energy, Washington, DC.

Coutant, C. C. 1996. A new year! Fisheries (Bethesda) 21(9): 24.

Coutant, C. C. 1996. Interfaces. Fisheries (Bethesda) 21(10): 40.

Coutant, C. C. 1996. Let's talk. Fisheries (Bethesda) 21(11): 32.

Coutant, C. C. 1996. Can we afford it? Fisheries (Bethesda) 21(12):26.

Coutant, C. C., P. A. Bisson, D. Goodman, J. A. Lichatowich, W. J. Liss, L. McDonald, P. Mundy, B. Riddell, J. A. Stanford, and R. N. Williams. 1997. Review of the National Marine Fisheries Service' "1996 Annual Report to the Oregon Department of Environmental Quality" related to waiver of dissolved gas standard. ISAB-97-1, Independent Scientific Advisory Board, Northwest Power Planning Council and National Marine Fisheries Service, Portland, Oregon.

Williams, R. N., L. D. Calvin, C. C. Coutant, M. W. Erho, jr., J. A. Lichatowich, W. J. Liss, W. E. McConnaha, P. R. Mundy, J. A. Stanford, R. R. Whitney, D. L. Bottom, and C. A. Frissell. 1996. Return to the River: Restoration of Salmonid Fishes in the Columbia River Ecosystem. Northwest Power Planning Council, Portland, Oregon.

Coutant, C. C. 1996. Juvenile migration. Chapter 6 in R. N. Williams, L. D. Calvin, C. C. Coutant, M. W. Erho, jr., J. A. Lichatowich, W. J. Liss, W. E. McConnaha, P. R. Mundy, J. A. Stanford, R. R. Whitney, D. L. Bottom, and C. A. Frissell. Return to the River: Restoration of Salmonid Fishes in the Columbia River Ecosystem. Northwest Power Planning Council, Portland, Oregon.

Coutant, C. C. 1996. Monitoring and evaluation. Chapter 9 in Williams, R. N., L. D. Calvin, C. C. Coutant, M. W. Erho, jr., J. A. Lichatowich, W. J. Liss, W. E. McConnaha, P. R. Mundy, J. A. Stanford, R. R. Whitney, D. L. Bottom, and C. A. Frissell. Return to the River: Restoration of Salmonid Fishes in the Columbia River Ecosystem. Northwest Power Planning Council, Portland, Oregon.

Cada, G. F., C. C. Coutant, and R. R. Whitney. 1997. Development of biological criteria for the design of advanced hydropower turbines. DOE/ID-10578. U. S. Department of Energy, Idaho Falls, Idaho.

Williams, R. N., P. A. Bisson, Coutant, C. C., D. Goodman, J. A. Lichatowich, W. J. Liss, L. McDonald, P. Mundy, B. Riddell, J. A. Stanford and R. R. Whitney. 1997. Report of the Independent Scientific Advisory Board regarding a research proposal for inclusion in the 1997 Smolt Monitoring Program. Comparative Survival Rate Study of Hatchery PIT Tagged Chinook. ISAB-97-2, Northwest Power Planning Council and National Marine Fisheries Service, Portland, Oregon.

Coutant, C. C. 1997. What do we believe? Fisheries (Bethesda) 22(1):30.

Coutant, C. C. 1997. Who's in charge here? Fisheries (Bethesda) 22(2):28.

Williams, R. N., P. A. Bisson, Coutant, C. C., D. Goodman, J. A. Lichatowich, W. J. Liss, L. McDonald, P. Mundy, B. Riddell, J. A. Stanford and R. R. Whitney. 1997. Ecological impacts of the flow provisions of the Biological Opinion for endangered Snake River salmon on resident fishes in the Hungry Horse and Libby systems in Montana, Idaho, and British Columbia. ISAB 97-3, Independent Scientific Advisory Board for the Northwest Power Planning Council, Portland, Oregon, and the National Marine Fisheries Service, Seattle, Washington.

Williams, R. N., P. A. Bisson, Coutant, C. C., D. Goodman, J. A. Lichatowich, W. J. Liss, L. McDonald, P. Mundy, B. Riddell, J. A. Stanford and R. R. Whitney. 1997. Report of the Independent Scientific Advisory Board regarding a research proposal for inclusion in the Columbia River Basin Fish and Wildlife Program: Lake Pend Oreille Fishery Recovery Project. ISAB 97-4, Northwest Power Planning Council and National Marine Fisheries Service, Portland, Oregon.

Coutant, C. C. 1997. An interface: Council of Aquatic Sciences. Fisheries (Bethesda) 22(3):33.

Williams, R. N., P. A. Bisson, Coutant, C. C., D. Goodman, J. A. Lichatowich, W. J. Liss, L. McDonald, P. Mundy, B. Riddell, J. A. Stanford, R. R. Whitney and S. S. Hanna. 1997. Review of a draft programmatic environmental impact statement: Impacts of Artificial Salmon and Steelhead Production Strategies in the Columbia River Basin. ISAB Report 97-5. Independent Scientific Advisory Board for the Northwest Power Planning Council, Portland, Oregon and the National Marine Fisheries Service, Seattle, Washington.

Coutant, C. C. 1997. When is artificial good? Fisheries (Bethesda) 22(4):36.

Coutant, C. C. 1997. Do we have it all together? Fisheries (Bethesda) 22(5):28.

Coutant, C. C. 1997. Taken for Granted. Fisheries (Bethesda) 22(6):32.

Coutant, C. C. 1997. Dumber every day: Fighting the stupidity complex. Fisheries (Bethesda) 22(7):24.

Coutant, C. C. 1997. Thermal Pollution. Pages 963-984, In: Kirk-Othmer Encyclopedia of Chemical Technology, Fourth Edition, Volume 23. John Wiley and Sons, Inc.

Williams, R. N., J. A. Lichatowich, P. A. Bisson, Coutant, C. C., R. Francis, D. Goodman, N. Huntly,L. McDonald, B. Riddell, J. A. Stanford, and S. S. Hanna. 1997. Review of the Columbia River Basin Fish and Wildlife Program as directed by the 1996 amendment to the Power Act. ISRP Report 97-1, Report of the Independent Scientific Review Panel for the Northwest Power Planning Council, Portland, Oregon.

Van Winkle, W., C. C. Coutant, H. I. Jager, J. S. Mattice, D. J. Orth, R. G. Otto, S. F. Railsback, and M. J. Sale. 1997. Essay--Uncertainty and instream flow standards: Perspectives based on hydropower research and assessment. Fisheries (Bethesda) 22(7):21-22.

Mulholland, P. J., G. R. Best, C. C. Coutant, G. M. Hornberger, J. L. Meyer, P. J. Robinson, J. R. Stenberg, R. E. Turner, F. Vera-Herrera, and R. G. Wetzel. 1997. Effects of climate change on freshwater ecosystems of the Southeastern United States and the Gulf Coast of Mexico. Hydrological Processes 11:949-970.

Coutant, C. C., P. Bisson, and P. Brouha. 1997. Management audit gives AFS headquarters good marks, makes suggestions for improvements. Fisheries (Bethesda) 22(8):16-18.

Coutant, C. C., L. D. Calvin, M. W. Erho, Jr., J. A. Lichatowich, W. J. Liss, W. E. McConnaha, P. R. Mundy, J. A. Stanford, R. R. Whitnery, R. N. Williams, D. L. Bottom, and C. A. Frissell. 1997. The normative river: an ecological vision for the recovery of the Columbia River salmon. Pages 50-59, *in* D. J. Mahoney, editor. Waterpower '97. Proceedings of the 1997 International Conference on Hydropower. American Society of Civil Engineers, New York.

Whitney, R. R., L. D. Calvin, M. W. Erho, Jr., and C. C. Coutant. 1997. Downstream passage for salmon at hydroelectric projects in the Columbia River Basin: Development, installation, and evaluation. ISAB 97-15, Independent Scientific Advisory Board, Northwest Power Planning Council and National Marine Fisheries Service, Portland, Oregon.

Coutant, C. C. 1998. What is "Normative" for fish pathogens? A perspective on the controversy over interactions between wild and cultured fish. Journal of Aquatic Animal Health 10:101-106.

Williams, R. N., P. A. Bisson, C. C. Coutant, D. Goodman, J. A. Lichatowich, W. J. Liss, L. McDonald, P. Mundy, B. Riddell, J. A. Stanford, and R. R. Whitney. 1997. Review of the August 8, 1997 Draft of the Snake River Salmon Recovery Plan. ISAB Report 97-6, Independent Scientific Advisory Board for the Northwest Power Planning Council, Portland, Oregon and the National Marine Fisheries Service, Seattle, Washington.

Williams, R. N., P. A. Bisson, C. C. Coutant, D. Goodman, J. A. Lichatowich, W. J. Liss, L. McDonald, P. Mundy, B. Riddell, J. A. Stanford, and R. R. Whitney. Review of the National Marine Fisheries Services' "1997 Draft Annual Report to the Oregon Department of Environmental Quality" Related to Waiver of Dissolved Gas Standard. Report ISAB 97-7. Independent Scientific Advisory Board for the

Northwest Power Planning Council, Portland, Oregon and the National Marine Fisheries Service, Seattle, Washington.

Williams, R. N., P. A. Bisson, C. C. Coutant, D. Goodman, J. A. Lichatowich, W. J. Liss, L. McDonald, P. Mundy, B. Riddell, J. A. Stanford, and R. R. Whitney. 1998. Review of the 1998 Work plan for the Comparative Survival Rate Study of Hatchery PIT Tagged Chinook. ISAB Report 98-1. Independent Scientific Advisory Board for the Northwest Power Planning Council, Portland, Oregon and the National Marine Fisheries Service, Seattle, Washington.

Coutant, C. C. 1998. Expert Review of Thermal Effects of Richard B. Russell Pumped Storage Project on Striped Bass in J. Strom Thurmond Reservoir. Report for U.S. Department of Justice, Washington, DC. Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Coutant, C. C., R. Best, P. Bloom, D. Boesch, J. Grassle, D. Grigal, R. Houghton, J. Klopatek, W. Lewis, H. Regier, T. Sharik, and D. Sprugel. 1998. Review of U. S. Environmental Protection Agency's National Health and Environmental Effects Research Laboratory Western Ecology Division. Unnumbered report. Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Williams, R. N., P. A. Bisson, C. C. Coutant, D. Goodman, J. A. Lichatowich, W. J. Liss, L. McDonald, P. Mundy, B. Riddell, J. A. Stanford, and R. R. Whitney. 1998. Response to Questions of the Implementation Team Regarding Juvenile Salmon Transportation in the 1998 Season. ISAB Report 98-2. Independent Scientific Advisory Board for the Northwest Power Planning Council, Portland, Oregon and the National Marine Fisheries Service, Seattle, Washington.

Williams, R. N., P. A. Bisson, C. C. Coutant, D. Goodman, J. A. Lichatowich, W. J. Liss, L. McDonald, P. Mundy, B. Riddell, J. A. Stanford, and R. R. Whitney. 1998. Independent Scientific Advisory Board 1997 Annual Report. ISAB Report 98-3. Independent Scientific Advisory Board for the Northwest Power Planning Council, Portland, Oregon and the National Marine Fisheries Service, Seattle, Washington.

Williams, R. N., P. A. Bisson, C. C. Coutant, D. Goodman, J. A. Lichatowich, W. J. Liss, L. McDonald, P. Mundy, B. Riddell, and R. R. Whitney. 1998. The Scientific Basis for Juvenile Fish Passage Improvements in the Federal Columbia River Power System: John Day Dam Extended Length Turbine Intake Screens and Bonneville Dam Bypass System Outfalls. First Report: The ISAB Corps Capital Construction Project Review. ISAB Report 98-4. Independent Scientific Advisory Board for the Northwest Power Planning Council, Portland, Oregon and the National Marine Fisheries Service, Seattle, Washington.

Bisson, P. A., C. C. Coutant, D. Goodman, J. A. Lichatowich, W. J. Liss, L. McDonald, P. Mundy, B. Riddell, R. R. Whitney, and R. N. Williams. 1998. Recommendation for Stable Flows in the Hanford Reach During the Time When Juvenile Fall Chinook are Present Each Spring. Report ISAB 98-5. Independent Scientific Advisory Board for the Northwest Power Planning Council, Portland, Oregon and the National Marine Fisheries Service, Seattle, Washington.

Bisson, P. A., C. C. Coutant, D. Goodman, J. A. Lichatowich, W. J. Liss, L. McDonald, P. Mundy, B. Riddell, R. R. Whitney, and R. N. Williams. 1998. Independent Scientific Advisory Board Review of "Development of a Regional Framework for Fish and Wildlife Restoration in the Columbia River

Basin". Report ISAB 98-6. Independent Scientific Advisory Board for the Northwest Power Planning Council, Portland, Oregon and the National Marine Fisheries Service, Seattle, Washington.

Bisson, P. A., C. C. Coutant, D. Goodman, J. A. Lichatowich, W. J. Liss, L. McDonald, P. Mundy, B. Riddell, R. R. Whitney, and R. N. Williams. 1998. Report of the Independent Scientific Advisory Board Review of the U.S. Army Corps of Engineers' Capital Construction Program. Part II. A. Development and Testing of Surface Bypass. Report ISAB 98-7. Independent Scientific Advisory Board for the Northwest Power Planning Council, Portland, Oregon and the National Marine Fisheries Service, Seattle, Washington.

Bisson, P. A., C. C. Coutant, D. Goodman, J. A. Lichatowich, W. J. Liss, L. McDonald, P. Mundy, B. Riddell, R. R. Whitney, and R. N. Williams. 1998. Report of the Independent Scientific Advisory Board Review of the U.S. Army Corps of Engineers' Capital Construction Program. Part II. B. Dissolved Gas Abatement Program. Report ISAB 98-8. Independent Scientific Advisory Board for the Northwest Power Planning Council, Portland, Oregon and the National Marine Fisheries Service, Seattle, Washington.

Williams, R. N., J. A. Lichatowich, P. A. Bisson, C. C. Coutant, R. Francis, D. Goodman, N. Huntly, L. McDonald, B. Riddell, and S. Hanna. 1998. Review of the Columbia River Basin Fish and Wildlife Program for Fiscal Year 1999 as Directed by the 1996 Amendment of the Northwest Power Act. ISRP Report 98-1. Independent Scientific Review Panel for the Northwest Power Planning Council, Portland, Oregon.

Coutant, C. C. 1998. Fisheries Delegation to the People's Republic of China. Citizen Ambassador Program of People to People International, Spokane, Washington.

Independent Scientific Group (R. N. Williams, chair; P. A. Bisson; D. L. Bottom; L. D. Calvin; C. C. Coutant; M. W. Erho, jr.; C. A. Frissell; J. A. Lichatowich; W. J. Liss; W. E. McConnaha; P. R. Mundy; J. A. Stanford; and R. R. Whitney). 1998. Return to the River: An ecological vision for the recovery of the Columbia River salmon. Environmental Law 28(3):503-518.

Coutant, C. C. 1998. Turbulent Attraction Flows for Juvenile Salmonid Passage at Dams. ORNL/TM-13608. Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Coutant, C. C., M. S. Bevelhimer, and W. Van Winkle. 1998. Brayton Point Station Section 316(a) and 316(b) Review. Prepared for Region 1, U.S. Environmental Protection Agency, Boston, Massachusetts by Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Independent Scientific Group (R. N. Williams, chair; P. A. Bisson; D. L. Bottom; L. D. Calvin; C. C. Coutant; M. W. Erho, jr.; C. A. Frissell; J. A. Lichatowich; W. J. Liss; W. E. McConnaha; P. R. Mundy; J. A. Stanford; and R. R. Whitney). 1999. Scientific Issues in the restoration of salmonid fishes in the Columbia River. Fisheries 24(3):10-19.

Coutant, C. C. 1999. Think like a fish! Emphasizing the behavior in behavioral guidance systems. Hydro Review 18(3) :18-24.

Coutant, C. C. 1999. Perspectives on temperature in the Pacific Northwest's fresh waters. ORNL/TM-1999/44. Report for U.S. Environmental Protection Agency, Region 10, Seattle, Washington. Oak Ridge National Laboratory , Oak Ridge, Tennessee.

Coutant, C. C., D. Goodman, S. S. Hanna, N. Huntly, D. Lettenmaier, J. Lichatowich, L. McDonald, B. Riddell, W. Smoker, R.R. Whitney, and R. N. Williams. 1999. Review of the BPA Reimbursable Account Programs in the Columbia River Basin as Requested in the Senate-House Conference Report on FY99 Energy and Water Development Appropriations Bill. Report ISRP-99-1. Independent Scientific Review Panel for the Northwest Power Planning Council, Portland, Oregon.

Coutant, C. C., D. Goodman, S. S. Hanna, N. Huntly, D. Lettenmaier, J. Lichatowich, L. McDonald, B. Riddell, W. Smoker, R.R. Whitney, and R. N. Williams. 1999. Review of the Columbia River Basin Fish and Wildlife Program for Fiscal Year 2000 as Directed by the 1966 Amendment of the Northwest Power Act. A Report of the Independent Scientific Reviw Panel for the Northwest Power Planning Council. (2 volumes). Report ISRP 99-2. Independent Scientific Review Panel for the Northwest Power Planning Council, Portland, Oregon.

Coutant, C. C., D. Goodman, S. S. Hanna, N. Huntly, D. Lettenmaier, J. Lichatowich, L. McDonald, B. Riddell, W. Smoker, R.R. Whitney, and R. N. Williams. 1999. Response review of fiscal year 2000 proposals. Report ISRP 99-4. Independent Scientific Review Panel for the Northwest Power Planning Council, Portland, Oregon.

Bisson, P. A., C. C. Coutant, D. Goodman, J. A. Lichatowich, W. J. Liss, L. McDonald, P. Mundy, B. Riddell, R. R. Whitney, and R. N. Williams. 1999. ISAB Review of "1998 Draft Annual Report to the Oregon Department of Environmental Quality" (December 1, 1998). Report ISAB 99-1. Independent Scientific Advisory Board for the Northwest Power Planning Council, Portland, Oregon and the National Marine Fisheries Service, Seattle, Washington.

Bisson, P. A., C. C. Coutant, D. Goodman, J. A. Lichatowich, W. J. Liss, L. McDonald, P. Mundy, B. Riddell, R. R. Whitney, and R. N. Williams. 1999. Report of the Independent Scientific Advisory Board Review of the U.S. Army Corps of Engineers' Capital Construction Program. Part I. Adult Passage. Report ISAB 99-2. Independent Scientific Advisory Board for the Northwest Power Planning Council, Portland, Oregon and the National Marine Fisheries Service, Seattle, Washington.

Bisson, P. A., C. C. Coutant, D. Goodman, J. A. Lichatowich, W. J. Liss, L. McDonald, P. Mundy, B. Riddell, R. R. Whitney, and R. N. Williams. 1999. Independent Scientific Advisory Board Work-In-Progress Report: Looking for Common Ground: Comparison of Recent Reports Pertaining to Salmon Recovery in the Columbia River Basin. Report ISAB 99-3. Independent Scientific Advisory Board for the Northwest Power Planning Council, Portland, Oregon and the National Marine Fisheries Service, Seattle, Washington.

Bisson, P. A., C. C. Coutant, D. Goodman, J. A. Lichatowich, W. J. Liss, L. McDonald, P. Mundy, B. Riddell, R. R. Whitney, and R. N. Williams. 1999. Report of the Independent Scientific Advisory Board Review of the U.S. Army Corps of Engineers' Capital Construction Program. Part III. Overview of the U.S. Army Corps of Engineers' Capital Construction Program. Report ISAB 99-4. Independent Scientific Advisory Board for the Northwest Power Planning Council, Portland, Oregon and the National Marine Fisheries Service, Seattle, Washington.

Bisson, P. A., C. C. Coutant, D. Goodman, R. Gramling, J. Lichatowich, E. Loudenslager, W. Liss, L. McDonald, D. Phillip, B. Riddell, and R. R. Whitney. 2000. Review of studies of fish survival in spill at The Dalles Dam. Report ISAB 2000-1. Independent Scientific Advisory Board for the Northwest Power Planning Council, Portland, Oregon and the National Marine Fisheries Service, Seattle, Washington.

Bisson, P. A., C. C. Coutant, D. Goodman, R. Gramling, J. Lichatowich, E. Loudenslager, W. Liss, L. McDonald, D. Phillip, and B. Riddell. 2000.Review of the draft performance standards and indicators for artificial production in the Northwest Power Planning Council's Artificial Production Review. Report ISAB 2000-2. Independent Scientific Advisory Board for the Northwest Power Planning Council, Portland, Oregon and the National Marine Fisheries Service, Seattle, Washington.

Bisson, P. A., C. C. Coutant, D. Goodman, R. Gramling, J. Lichatowich, E. Loudenslager, L. McDonald, D. Phillip, and B. Riddell. 2000. The Columbia River Estuary and the Columbia River Basin Fish and Wildlife Program. Report ISAB 2000-5. Independent Scientific Advisory Board for the Northwest Power Planning Council, Portland, Oregon and the National Marine Fisheries Service, Seattle, Washington.

ISAB. 2000. Consistency of the Council's artificial production policies and implementation strategies with multi-species framework principles and Scientific Review Team guidelines. Report ISAB 2000-3. Independent Scientific Advisory Board for the Northwest Power Planning Council, Portland, Oregon and the National Marine Fisheries Service, Seattle, Washington.

ISRP (Independent Scientific Review Panel). 2000. Review of Coeur d'Alene Tribe trout production facility master plan. Report ISRP 2000-1. Independent Scientific Review Panel for the Northwest Power Planning Council, Portland, Oregon.

ISRP. 2000. Review of the Tucannon River captive broodstock Master Plan. Report ISRP 2000-2. Independent Scientific Review Panel for the Northwest Power Planning Council, Portland, Oregon.

ISRP. 2000. Review of databases funded through the Columbia River Basin Fish and Wildlife Program. Report ISRP 2000-3. Independent Scientific Review Panel for the Northwest Power Planning Council, Portland, Oregon.

ISRP. 2000. Review of "Restoration plan for Pacific lamprey (Lampetra tridentata) in the Umatilla, River, Oregon." Report ISRP 2000-4. Independent Scientific Review Panel for the Northwest Power Planning Council, Portland, Oregon.

ISRP. 2000. Review of the master plan for feasibility assessment of a white sturgeon 'put and take" consumptive fisheries in Oxbow and Hells Canyon reservoirs, Snake River. Report ISRP 2000-6, Independent Scientific Review Panel for the Northwest Power Planning Council, Portland, Oregon.

ISRP 2000. Final review of fiscal year 2001 project proposals for the Columbia River Gorge and Intermountain provinces. Report ISRP 2000-9. Independent Scientific Review Panel for the Northwest Power Planning Council, Portland, Oregon.

Coutant, C. C. 2000. Cool refuges for big striped bass: Twenty years of testing the thermal squeeze hypothesis. Proceedings of the Gulf Coast Striped Bass Management Workshop (Nov. 1998). U.S. Fish and Wildlife Service, Mobile, Alabama.

Coutant, C. C. 2000. What is 'normative' at cooling water intakes? Defining normalcy before judging adverse. Environmental Science & Policy 3:S37-S42.

Coutant, C. C., and R. R. Whitney. 2000. Fish behavior in relation to passage through hydropower turbines: a review. Transactions of the American Fisheries Society 129:351-380.

Coutant, C. C., and M. S. Bevelhimer. 2000. Technical evaluation of the utility of intake approach velocity as an indicator or potential adverse environmental impact under Clean Water Act Section 316(b). Technical Report 1000731. EPRI, Palo Alto, California.

Bisson, P. A., C. C. Coutant, D. Goodman, R. Gramling, D. Lettenmaier, J. Lichatowich, E. Loudenslager, W. Liss, L. McDonald, D. Phillip, and B. Riddell. 2000. Model synthesis report. An analysis of decision support tools used in Columbia River Basin salmon management. Report ISAB 2001-1. Independent Scientific Advisory Board for the Northwest Power Planning Council, Portland, Oregon and the National Marine Fisheries Service, Seattle, Washington.

ISAB. 2001. Research and monitoring in a low-flow year. Report ISAB 2001-2. Independent Scientific Advisory Board for the Northwest Power Planning Council, Portland, Oregon and the National Marine Fisheries Service, Seattle, Washington.

ISAB. 2001. Hatchery surplus review. Report ISAB 2001-3. Independent Scientific Advisory Board for the Northwest Power Planning Council, Portland, Oregon and the National Marine Fisheries Service, Seattle, Washington.

ISAB. 2001. Recommendations on Council staff's draft issue paper "Analysis of 2001 Federal Columbia River Basin System Operations on Fish Survival." Report ISAB 2001-4. Independent Scientific Advisory Board for the Northwest Power Planning Council, Portland, Oregon and the National Marine Fisheries Service, Seattle, Washington.

ISAB. 2001. Review of Lower Snake River flow augmentation studies. Report ISAB 2001-5. Independent Scientific Advisory Board for the Northwest Power Planning Council, Portland, Oregon and the National Marine Fisheries Service, Seattle, Washington.

ISAB. 2001. Review of the Biological Objectives in the 2000 Fish and Wildlife Program. Report ISAB 2001-6. Independent Scientific Advisory Board for the Northwest Power Planning Council, Portland, Oregon and the National Marine Fisheries Service, Seattle, Washington.

Coutant, C. C. (editor). 2001. Behavioral technologies for fish guidance. American Fisheries Society Symposium 26. Bethesda, Maryland.

Coutant, C. C. 2001. Turbulent attraction flows for guiding juvenile salmonids at dams. Pages 45-65. In C. C. Coutant, editor. Behavioral technologies for fish guidance. American Fisheries Society Symposium 26. Bethesda, Maryland.

Coutant, C. C. 2001. Integrated, multi-sensory behavioral guidance systems for fish diversions. Pages 105-113. In C. C. Coutant, editor. Behavioral technologies for fish guidance. American Fisheries Society Symposium 26. Bethesda, Maryland

Committee on Environment and Natural Resources, National Technology Council. 2000. From the Edge: Science to support restoration of Pacific salmon. Office of Science and Technology Policy, Washington, DC. (C. C. Coutant, principal author).

Independent Scientific Group. 2000. Return to the River 2000. Restoration of salmonid fishes in the Columbia River ecosystem. Report 2000-12. Northwest Power Planning Council, Portland, Oregon.

ISAB. 2001. A review of salmon recovery strategies for the Columbia River Basin. Report ISAB 2001-7. Independent Scientific Advisory Board for the Northwest Power Planning Council, Portland, Oregon and the National Marine Fisheries Service, Seattle, Washington.

ISRP. 2001. Review of FY High Priority proposals for the Columbia River Basin Fish and Wildlife Program. Report ISRP-2001-1. Independent Scientific Review Panel for the Northwest Power Planning Council, Portland, Oregon.

ISRP. 2001. Preliminary review of FY 2002 project proposals for the Mountain Columbia Province. Report ISRP-2001-2. Independent Scientific Review Panel for the Northwest Power Planning Council, Portland, Oregon.

ISRP. 2001. Final review of FY 2002 project proposals for the Mountain Columbia Province. Report ISRP-2001-3. Independent Scientific Review Panel for the Northwest Power Planning Council, Portland, Oregon.

ISRP. 2001. Preliminary review of fiscal year 2002 project proposals for the Columbia Plateau province. Report ISRP-2001-6. Independent Scientific Review Panel for the Northwest Power Planning Council, Portland, Oregon.

ISRP. 2001. Review of Fiscal Year 2001 Action Plan proposals. Report ISRP-2001-7. Independent Scientific Review Panel for the Northwest Power Planning Council, Portland, Oregon.

ISRP. 2001. Final review of Fiscal Year 2001 Action Plan proposals including responses to ISRP comments. Report ISRP-2001-7a. Independent Scientific Review Panel for the Northwest Power Planning Council, Portland, Oregon.

ISRP. 2001. Final review of Fiscal Year 2002 proposals for the Columbia Plateau Province. Report ISRP-2001-8. Independent Scientific Review Panel for the Northwest Power Planning Council, Portland, Oregon.

ISRP. 2001. Preliminary review of the United States Army Corps of Engineers' Bonneville Decision Document Juvenile Fish Passage Recommendation October 2001. Report ISRP-2001-11. Independent Scientific Review Panel for the Northwest Power Planning Council, Portland, Oregon.

ISAB. 2002. Review of Giorgi et al. report: "Mainstem Passage Strategies in the Columbia River System: Transportation, Spill, and Flow Augmentation." Report ISAB-2002-1. Independent Scientific Advisory Board for the Northwest Power Planning Council, Portland, Oregon and the National Marine Fisheries Service, Seattle, Washington.

ISRP. 2002. ISRP comments on Corps' response to Document ISRTP 2001-11. Report ISRP-2001-11a. Independent Scientific Review Panel for the Northwest Power Planning Council, Portland, Oregon.

ISRP. 2002. Final review: Arrowleaf/Methow River Conservation Project. Report ISRP-2002-1. Independent Scientific Review Panel for the Northwest Power Planning Council, Portland, Oregon.

ISRP. 2002. Preliminary review of Fiscal Year 2003 proposals for the Upper and Middle Snake, Columbia Cascade, and Lower Columbia and Estuary provinces. Report ISRP-2002-2. Independent Scientific Review Panel for the Northwest Power Planning Council, Portland, Oregon.

ISRP. 2002. Review of protocols for the inventory and monitoring of fish, wildlife, and their habitats in the Pacific Northwest; statement of work by David H. Johnson, Washington Department of Fish and Wildlife. Report ISRP-2002-3. Independent Scientific Review Panel for the Northwest Power Planning Council, Portland, Oregon.

ISRP. 2002. Review of Council staff's draft research plan for fish and wildlife in the Columbia River basin. Report ISRP-2002-4. Independent Scientific Review Panel for the Northwest Power Planning Council, Portland, Oregon.

ISRP. 2002. Review of March 27, 2002 Draft Guidelines for Action Effectiveness Research Proposals for FCRPS Offsite Mitigation Measures. Report ISRP-2002-5. Independent Scientific Review Panel for the Northwest Power Planning Council, Portland, Oregon.

ISRP. 2002. Review of 2002 Innovative Proposals. Report ISRP-2002-8. Independent Scientific Review Panel for the Northwest Power Planning Council, Portland, Oregon.

ISRP. 2002. Review of revised Moses Lake Recreational Facility proposal. Report ISRP-2002-9. Independent Scientific Review Panel for the Northwest Power Planning Council, Portland, Oregon.

ISRP. 2002. Review of project 200101500 – Echo Meadow Project. Report ISRP-2002-10. Independent Scientific Review Panel for the Northwest Power Planning Council, Portland, Oregon.

ISRP. 2002. Final review of Fiscal Year 2003 proposals for the Upper and Middle Snake, Columbia Cascade, and Estuary provinces. Report ISRP-2002-11. Independent Scientific Review Panel for the Northwest Power Planning Council, Portland, Oregon.

ISRP. 2002. Preliminary review of Fiscal Year 2003 Mainstem and Systemwide proposals. Report ISRP-2002-13. Independent Scientific Review Panel for the Northwest Power Planning Council, Portland, Oregon.

ISRP. 2002. Final review of Fiscal Year 2003 Mainstem and Systemwide proposals. Report ISRP-2002-14. Independent Scientific Review Panel for the Northwest Power Planning Council, Portland, Oregon.

ISRP. 2002. Review of criteria for evaluating proposals to secure tributary water. Report ISRP-2002-15. Independent Scientific Review Panel for the Northwest Power Planning Council, Portland, Oregon.

ISAB. 2003. Review of flow augmentation: update and clarification. Report ISAB-2003-1. Independent Scientific Advisory Board for the Northwest Power Planning Council, Portland, Oregon and the National Marine Fisheries Service, Seattle, Washington.

ISAB. 2003. Review of strategies for recovery of tributary habitat. Report ISAB-2003-2. Independent Scientific Advisory Board for the Northwest Power Planning Council, Portland, Oregon and the National Marine Fisheries Service, Seattle, Washington.

ISAB. 2003. Review of salmon and steelhead supplementation. Report ISAB-2003-3. Independent Scientific Advisory Board for the Northwest Power Planning Council, Portland, Oregon and the National Marine Fisheries Service, Seattle, Washington.

Williams, M. A., and C. C. Coutant. 2003. Modification of schooling behavior in larval atherinid fish *Atherina mochon* by heat exposure of eggs and larvae. Transactions of the American Fisheries Society 132:638-645.

ISRP. 2003. Summary of ISRP reviews and interactions with the Action Agencies' RM&E effort. Report ISRP-2003-2. Independent Scientific Review Panel for the Northwest Power and Conservation Council, Portland, Oregon.

ISRP. 2003. Review of draft Clearwater Subbasin Plan. Report ISRP-2003-3. Independent Scientific Review Panel for the Northwest Power and Conservation Council, Portland, Oregon.

ISRP. 2003. Review of BPA's draft Request for Proposals for RM&E. Report ISRP-2003-4. Independent Scientific Review Panel for the Northwest Power and Conservation Council, Portland, Oregon.

ISRP. 2003. Review of revised mainstem/systemwide proposals for research, monitoring and evaluation. Report ISRP-2003-6. Independent Scientific Review Panel for the Northwest Power and Conservation Council, Portland, Oregon.

ISRP. 2003. Review of proposals for BPA's request for studies on RPAs 182 and 184. Report ISRP-2003-7. Independent Scientific Review Panel for the Northwest Power and Conservation Council, Portland, Oregon.

ISRP. 2003. Final review of proposals submitted in response to Bonneville Power Administration's March 14, 2003 request for studies for Reasonable and Prudent Alternative Actions 182 and 184 of the 2000 Federal Columbia River Power System Biological Opinion. Report ISRP-2003-9. Independent Scientific Review Panel for the Northwest Power and Conservation Council, Portland, Oregon.

ISRP. 2003. Review of the Umatilla Fish Hatchery monitoring and evaluation project (19900500) document, "Comprehensive Assessment of Salmonid Restoration and Enhancement Efforts in the Umatilla River Basin." Report ISRP-2003-10. Independent Scientific Review Panel for the Northwest Power and Conservation Council, Portland, Oregon.

ISRP. 2003. Review of protocols for counting salmonids, resident fish, and lampreys in the Pacific Northwest. Report ISRP-2003-11. Independent Scientific Review Panel for the Northwest Power and Conservation Council, Portland, Oregon.

Bevelhimer, M. S., and C. C. Coutant. 2003. Impacts of volumetric flow rate of water intakes on fish populations and communities. Technical Report 1005178. EPRI, Palo Alto, California.

Coutant, C. C. 2004. A riparian habitat hypothesis for successful reproduction of white sturgeon. Reviews in Fisheries Science 12:23-73.

Coutant, C. C., D. Goodman, S. Hanna, L. McDonald, B. Riddell, N. Huntly, W. Liss, W. Smoker, R. R. Whitney, R. Williams, R. Bilby, P. A. Bisson, E. J. Loudenslager, and D. P. Philipp. 2004. A Joint ISAB and ISRP Review of the Draft Research, Monitoring & Evaluation Plan for the NOAA Fisheries 2000 Federal Columbia River Power System Biological Opinion. Independent Scientific Advisory Board and Independent Scientific Review Panel Report ISAB & ISRP 2004-1. Northwest Power and Conservation Council, Northwest Indian Tribes, and NOAA Fisheries, Portland, Oregon. 66 pages.

Bilby, R. E., P. A. Bisson, C. C. Coutant, D. Goodman, S. Hanna, E. Loudenslager, L. McDonald, D. Philipp, and B. Riddell. 2003. ISAB Comments on Draft NOAA Technical Recovery Team Documents Identifying Independent Salmonid Populations Within Evolutionarily Significant Units. Independent Scientific Advisory Board Report ISAB 2003-4. NOAA Fisheries, Northwest Indian Tribes, and Northwest Power and Conservation Council, Portland, Oregon. 12 pages.

Coutant, C. C., S. Hanna, N. Huntly, W. Liss, L. McDonald, B. Riddell, W. Smoker, R. Whitney, R. N. Williams, J. D. McIntyre, T. Poe, and E. Merrill. 2004. Final Review of the United States Army Corps of Engineers' Anadromous Fish Evaluation Program for Fiscal Year 2004. Independent Scientific Review Panel Report ISRP 2004-8. Northwest Power and Conservation Council, Portland, Oregon. 106 pages.

Coutant, C. C., S. Hanna, N. Huntly, W. Liss, L. McDonald, B. Riddell, R. R. Whitney, R. N. Williams, J. Griffith, and R. White. 2004. Review of Draft Clearwater Subbasin Plan

(November 2003 version). Independent Scientific Review Panel Report ISRP 2004-4. Northwest Power and Conservation Council, Portland, Oregon. 33 pages.

Coutant, C. C., S. Hanna, N. Huntly, W. Liss, L. McDonald, B. Riddell, W. Smoker, R. Whitney, R. N. Williams, J. D. McIntyre, T. Poe, and E. Merrill. 2003. Review of Fiscal Year 2004 Pre-proposals for the United States Army Corps of Engineers' Anadromous Fish Evaluation Program. Independent Scientific Review Panel Report ISRP 2003-14. Northwest Power and Conservation Council, Portland, Oregon. 47 pages

Coutant, C. C., D. Goodman, S. Hanna, L. McDonald, B. Riddell, N. Huntly, W. Liss, W. Smoker, R. R. Whitney, R. Williams, R. Bilby, P. A. Bisson, E. J. Loudenslager, and D. P. Philipp, R. Aldridge, S. Gregory, J. Griffith, L. Hardesty, J. Karr, J. Lichatowich, J. McIntyre, T. Poe, D. Scarnecchia, B. Ward, E. Merrill, D. Spear, and E. Schrepel. 2004. Scientific Review of Subbasin Plans for the Columbia River Basin Fish and Wildlife Program. Independent Scientific Review Board and Independent Scientific Advisory Board Report 2004-13, NOAA Fisheries, Northwest Indian Tribes and Northwest Power and Conservation Council, Portland Oregon. 152 pages.

ISAB. 2004. ISAB Findings from the Reservoir Operations / Flow Survival Symposium. Report ISAB 2004-2. Northwest Power and Conservation Council, Portland, Oregon.

ISAB. 2005. Review of the Pacific Northwest Aquatic Monitoring Partnership's "Study Design for Comparing Monitoring Protocols". Report ISAB 2005-1. Northwest Power and Conservation Council, Portland, Oregon.

ISAB. 2005. Viability of ESUs Containing Multiple Types of Populations. Report ISAB 2005-2. Northwest Power and Conservation Council, Portland, Oregon.

ISAB. 2005. Recommendation to Study Effects of Load Following on Juvenile Salmon Migratory Behavior and Survival. Report ISAB 2005-3. Northwest Power and Conservation Council, Portland, Oregon.

ISAB. 2005. Report on Harvest Management of Columbia River Salmon and Steelhead. Report ISAB 2005-4. Northwest Power and Conservation Council, Portland, Oregon.

ISAB. 2005. Review of the All-H Analyzer (AHA). Report ISAB 2005-5. Northwest Power and Conservation Council, Portland, Oregon.

ISRP. 2004. Review of Captive Propagation Program Elements: Programmatic Issue 12 for the Mountain Snake and Blue Mountain Provinces. Report ISRP 2004-14. Northwest Power and Conservation Council, Portland, Oregon.

ISRP. 2004. Estuary and Lower Columbia Habitat Monitoring and RME Plan Reviews. Report ISRP 2004-16. Northwest Power and Conservation Council, Portland, Oregon.

ISRP. 2004. Review of Umatilla RM&E Plan. Report ISRP 2004-17. Northwest Power and Conservation Council, Portland, Oregon.

ISRP. 2005. Review of Criteria and Checklist for Evaluating Proposals to Secure Riparian Easements to Protect Tributary Habitat. Report ISRP 2005-1. Northwest Power and Conservation Council, Portland, Oregon.

ISRP. 2005. Combined Step Review for Re-introduction of Lower Columbia River Chum Salmon into Duncan Creek. Report ISRP 2005-3. Northwest Power and Conservation Council, Portland, Oregon.

ISRP. 2005. Review of Select Area Fishery Evaluation Project. Report ISRP 2005-8. Northwest Power and Conservation Council, Portland, Oregon.

ISRP. 2005. Review of Updated Proposed Action (UPA) Habitat Projects to Improve Survival of Upper Columbia River Spring Chinook and Steelhead. Report ISRP 2005-9. Northwest Power and Conservation Council, Portland, Oregon.

ISRP and ISAB. 2005. Preliminary Review of Draft Research Plan. Report ISRP/ISAB 2005-13. Northwest Power and Conservation Council, Portland, Oregon.

ISRP. 2005. Retrospective Report 1997-2005. Report ISRP 2005-14. Northwest Power and Conservation Council, Portland, Oregon. 150 pages.

ISAB. 2006. Review of the 2005 Comparative Survival Studies' Annual Report and Applicability of Comparative Survival Studies' Analysis Results. Report ISAB 2006-3. Northwest Power and Conservation Council, Portland, Oregon.

ISRP. 2006. Preliminary Review of FY 2007-09 Proposals for the Columbia River Basin Fish and Wildlife Program. Report ISRP 2006-4. Northwest Power and Conservation Council, Portland, Oregon.

ISRP. 2006. ISRP Final Review of Proposals Submitted for Fiscal Year 2007-2009 Funding Through the Columbia River Basin Fish and Wildlife Program. Report ISRP 2006-6. Northwest Power and Conservation Council, Portland, Oregon.

Coutant, C. C., R. Mann, and M. J. Sale. 2006. Reduced Spill at Hydropower Dams: Opportunities for More Generation and Increased Fish Protection. Report ORNL/TM-2005/179. Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Liss, W. L., J. A. Stanford, J. A. Lichatowich, R. N. Williams, C. C. Coutant, P. R. Mundy, and R. R. Whitney. 2006. Chapter 3: A foundation for restoration. Pages 51-98. IN: R. N. Williams, editor. Return to the River: Restoring Salmon to the Columbia River. Elsevier Academic Press, Amsterdam.

Stanford, J. A., C. A. Frissell, and C. C. Coutant. 2006. Chapter 5: The status of habitats. Pages 173-248. IN: R. N. Williams, editor. Return to the River: Restoring Salmon to the Columbia River. Elsevier Academic Press, Amsterdam.

Coutant, C. C., and R. R. Whitney. 2006. Chapter 6: Hydroelectric systems and migration. Pages 249-324. IN: R. N. Williams, editor. Return to the River: Restoring Salmon to the Columbia River. Elsevier Academic Press, Amsterdam.

Whitney, R. R., C. C. Coutant, and P. R. Mundy. 2006. Chapter 7: Sources of mortality and effectiveness of mitigation. Pages 325-416. IN: R. N. Williams, editor. Return to the River: Restoring Salmon to the Columbia River. Elsevier Academic Press, Amsterdam.

McDonald, L. L., C. C. Coutant, L. D. Calvin, and R. N. Williams. 2006. Chapter 11: Monitoring and evaluation. Pages 571-600. IN: R. N. Williams, editor. Return to the River: Restoring Salmon to the Columbia River. Elsevier Academic Press, Amsterdam.

Bisson, P. A., J. A. Lichatowich, W. J. Liss, D. Goodman, C. C. Coutant, L. L. McDonald, D. Lettenmeier, E. J. Loudenslager, and R. N. Williams. 2006. Chapter 12: The federal approach to salmon recovery at the mellinium. Pages 601-628. IN: R. N. Williams, editor. Return to the River: Restoring Salmon to the Columbia River. Elsevier Academic Press, Amsterdam.

Williams, R. N., J. A. Stanford, J. A. Lichatowich, W. J. Liss, C. C. Coutant, W. E. McConnaha, R. R. Whitney, P. R. Mundy, P. A. Bisson, and M. S. Powell. 2006. Chapter 13: Conclusions and strategies for salmon restoration in the Columbia River Basin. Pages 629-666. IN: R. N. Williams, editor. Return to the River: Restoring Salmon to the Columbia River. Elsevier Academic Press, Amsterdam.

McDonald, L. L., R. Bilby, P. A. Bisson, C. C. Coutant, J. M. Epifanio, D. Goodman, S. Hanna, N. Huntly, E. Merrill, B. Riddell, W. Liss, E. J. Loudenslager, D. P. Philipp, W. Smoker, R. R. Whitney, and R. N. Williams. 2007. Research, monitoring, and evaluation of fish and wildlife restoration projects in the Columbia River basin. Fisheries 32(12):582-590.

Bevelhimer, M. S., and C. C. Coutant. 2008. Light tags for observing behavior of surface-oriented migrating salmonids. American Fisheries Society Symposium 61:231-239.

Bevelhimer, M. S., A. M. Fortner, C. C. Coutant, and B. A. Fost. 2008. Evaluation of strobe lights for reducing fish impingement at cooling water intakes. Tests in Alabama and Tennessee. Report No. 1015577 Electric Power Research Institute, Palo Alto, California.

Coutant, C. C., S. McDougall, and J. Young. 2008. Establishing alternative numerical limits for rate of temperature change. Report No. 1016470, Electric Power Research Institute, Palo Alto, California.

Coutant, C. C. 2008. Sixty years of trying to set temperature criteria and standards to protect aquatic life. Pages 2-1 to 2-11, In: C. Lew and W. Mills, editors. Proceedings: Second thermal ecology and regulation workshop. Report No. 1016809, Electric Power Research Institute, Palo Alto, California.

Notes:
1. Some ISAB and ISRP reports are listed as ISAB or ISRP authorship, without all board members' names. ISRP reports are listed only when I was a coauthor; other ISRP numbered reports did not include me as part of the review team. Short letter reports are not included.
2. Proprietary consulting reports are not included.

EXHIBIT:

Resume of Dudley W. Reiser, Ph.D.

DUDLEY W. REISER, Ph.D. – PRESIDENT
Senior Fisheries Scientist

Dr. Reiser is a fisheries scientist and the President of R2 Resource Consultants, and has more than 30 years experience designing, implementing, and managing fisheries and aquatic ecology projects, and habitat and instream flow assessments. His particular areas of expertise include fish ecology (anadromous and resident species), habitat assessments and criteria development, endangered species evaluations, assessments of flow regulation on fish populations and habitats, fisheries habitat enhancement, fisheries engineering, instream flow studies, assessments of sedimentation impacts on aquatic ecosystems, and flushing flow studies (related to sediment deposition).

EDUCATION

Ph.D. (Forestry, Wildlife and Range Sciences – major in fishery resources) University of Idaho, 1981
M.S. (Water Resources) University of Wyoming, 1976
B.A. (Zoology) Miami University, Ohio, 1972

PROFESSIONAL AFFILIATIONS AND CERTIFICATIONS

Certified USFWS IFIM Course - Computer Modeling (201), IFIM:IFG210, SNTEMP (310)
Certified USFWS Course - Expert Witness Seminar
Certified SCUBA DIVER - PADI and YMCA
American Fisheries Society (AFS), Certified Fisheries Scientist (No. 1447), Re-Certified (No. 2463)
Society of Environmental Toxicology and Chemistry
Co-Chairman, AFS Water Development and Streamflow Committee (1986-1989)
Secretary-Treasurer, Western Division, American Fisheries Society, 1987-1988
Co-editor, Sustainable Fisheries – Pacific Salmon, Lewis Publishers
Past Member, Editorial Board, "Rivers: Studies in the Science, Environmental Policy, and Law of Flowing Waters" (ongoing member since 1992)
Member, ESA Task Force for the City of Seattle – 1994
Member, CALFED Ecosystem Roundtable Committee focused on review and prioritization of restoration projects in the San Francisco Bay-Delta Area (1998)
Member, NRDA Practitioner Group (2000-2001), AdHoc Industry Natural Resource Damage Group
Member, Independent Science Panel (ISP) – Washington State – appointed by Governor Gary Locke to serve on Salmon Recovery Science Panel, Term: 1999-2003; reappointed by Governor Gregoire through 2006

EMPLOYMENT HISTORY

R2 Resource Consultants, Inc., Redmond, Washington, President, Senior Fisheries Scientist, 1992-Present
EA Engineering, Science, and Technology, Redmond, Washington, Vice President, Senior Fisheries Scientist, 1987-1992
Bechtel Corporation, San Francisco, California, Senior Fisheries Scientist, 1982-1987

Camp Dresser and McKee Inc., Denver, Colorado, Senior Fisheries Scientist, 1980-1982
Idaho Cooperative Fishery Research Unit, Moscow, Idaho, 1977-1980
Wyoming Water Resources Research Institute, Laramie, Wyoming, 1974-1977

EXPERIENCE

Hydroelectric Project Licensing Studies: Dr. Reiser has worked on licensing/relicensing studies on over 20 hydroelectric projects. These have included most recently, the Henry M. Jackson Hydroelectric Project (Washington), Boundary Hydroelectric Project (Washington), Skagit Project (Washington), White River (Washington), Clackamas (Oregon), Deschutes (Oregon), Carmen-Smith (Oregon), Connell and Whitman (Alaska), Cooper Lake (Alaska), Upper American River (California), Big Creek (California), Tapoco (North Carolina), Natahala (North Carolina), and Missouri-Madison (Montana). He has provided both technical and strategic support on many of these projects and has worked from the utility, stakeholder, and the FERC perspective. His working experience on these projects has involved the traditional, ALP, and ILP relicensing procedures. In addition, for the Clackamas Project, he served as the aquatic and fisheries resource lead for a 3rd party DEIS prepared for the FERC. Dr. Reiser also recently served as the Project Manager of a national technical support contract with the U.S. Forest Service where he participated in instream flow related studies associated with hydroelectric relicensing involving a number of resource issues including fish flows, temperature modifications, impacts of flow fluctuations, impacts of whitewater flows on aquatic biota, and sediment transport issues. Most recently, he directed three studies being completed as part of the ILP process for the Jackson Hydroelectric Project.

Endangered Species Issues: Direct experience in working on endangered species issues related to resource developments, including those that influence streamflow, temperature, habitat quality and quantity. Project Manager of technical studies on bull trout for Seattle Water Department (SWD); assisted in coordination of studies for integration into SWD Habitat Conservation Plan (HCP); represented SWD on ESA task force focused on listing status of species of special concern related to SWD facility operations. Project Manager for Tri-County Urban Issues ESA response project focused on evaluating restoration options for listed Chinook salmon within urban watersheds. Project Manager of an HCP being developed for the J.L. Storedahl & Sons Daybreak Mine located near the East Fork Lewis River, Washington, and more recently an HCP for the City of Kent's water supply. Project Manager for development of restoration plans for reintroducing the federally listed endangered Snake River Chinook salmon into the Panther Creek drainage in Idaho; worked with federal and state agencies in developing plan compatible with mandates of ESA and state and federal directives relative to reintroduction strategies. Project Manager for bull trout evaluation for the Seattle City Light in connection with the Boundary Hydroelectric Project and Ross Lake Project.

Fish Population Assessments: Directed numerous studies focused on determining fish population abundance and dynamics in streams and rivers. These have most recently included fish studies conducted for the City of Kent pertaining to the Green River Natural Resources Area, and streams that may be influenced by the revised Critical Areas Ordinance; General Electric (Housatonic River, Massachusetts), the Seattle Water Department (Lake Chester Morse and Cedar watershed), Montana Power Company (Holter and Hauser reservoirs; Missouri River), Atlantic Richfield Company (Clark Fork River and tributaries), U.S. Fish and Wildlife Service (Coeur d'Alene basin and St. Regis Rivers), J.L. Storedahl

Company (series of gravel ponds adjacent to the East Fork Lewis River), and Ketchikan Public Utilities (Whitman and Connell lakes, and tributaries). Dr. Reiser has recently initiated a study for the City of Seattle evaluating the effects of reservoir management on bull trout redds and egg survival. Fishery surveys often include use of a variety of gear types including electrofishing, seining, gill netting, trapping, hook and line, and snorkeling.

Fisheries Habitat Enhancement: Project manager for a mine reclamation fishery habitat enhancement project for the Bonneville Power Administration (BPA) for Panther Creek, Idaho; a fisheries engineering habitat enhancement project on the Yankee Fork of the Salmon River, Idaho, for the Shoshone-Bannock Indian Tribes; a habitat enhancement project on the East Fork Salmon River Idaho for the Shoshone-Bannock Tribes, a tributary improvement study for Pacific Gas and Electric Company (PG&E) in California; a feasibility study for developing an artificial spawning channel in Montana; a gravel supplementation study to evaluate options for increasing brown and rainbow trout spawning success within the Madison River below Madison Dam (for Montana Power Company); and most recently, development of habitat restoration options designed to restore runs of Chinook salmon back to Panther Creek (conducted for NMFS). Enhancement measures included instream structures, bank stabilization, spawning channel development, spawning gravel supplementation, rearing pond development (low-technology and natural), and barrier removal, mine tailings pond stabilization, and dam removal. Project Manager of biomonitoring studies of the Mill-Willow Bypass channel in Montana, a channel that was completely reconstructed following the removal of mine tailings and floodplain construction. The studies have included assessments of habitat, monitoring of invertebrate communities, water quality and fish recolonization.

Habitat Modeling, Instream Flow and Flushing Flow Determinations: Extensive experience in the area of habitat and instream flow assessments in Alaska, California, Colorado, Idaho, Montana, New York, Vermont, North Carolina, Oregon, Washington, and Wyoming. Has applied a variety of IF methods including the USFWS IFIM/PHABSIM, Tennant (Montana) Method, Wetted Perimeter (WP), Trout Cover Rating (TCR), Toe-width, R-2 Cross Method, and the New England Method. Project Manager and Principal-in-charge of one of the largest instream flow studies conducted in North America; the study was conducted as part of the Snake River Basin Adjudication and included over 1100 basins within the Salmon and Clearwater basins of Idaho. Other ongoing and recent instream flow projects directed by Dr. Reiser include: instream flow and lake level recommendations related to the Klamath River Basin Adjudication (for the BIA), determination of flow recommendations for the Duck Valley Indian Reservation, Nevada and Idaho (for the BIA), an assessment of instream flow requirements below Madison Dam, Montana (conducted for the Montana Power Company), and instream flow studies on Ward Creek below Connell Dam and Whitman Creek below Whitman Dam near Ketchikan, Alaska (conducted for Ketchikan Public Utility). Dr Reiser is also the Project Manager of a national instream flow support contract to the U.S. Forest Service to provide technical assistance related to instream flow issues associated with hydroelectric relicensing. He was also involved in a study for the Chelan PUD evaluating instream flow and passage flows within a bypass reach below Lake Chelan. Project Manager of a study conducted for Alberta Environment focused on developing an approach for determining instream flow needs for streams throughout the province. Completed four studies related to flushing flows, including the development of guidelines for recommending flushing flows, and formulation of specific flow recommendations for two California streams and two major river systems in Montana.

Habitat Assessments and Habitat Suitability Curve Development: Principal investigator of a comparative habitat study evaluating limiting factors within the Clark Fork River, Montana. Applied a variety of habitat quantification methods including IFIM, Habitat Quality Index (HQI), Habitat Suitability Index system (HSI), and Trout Cover Rating (TCR). Project Manager of a comprehensive aquatic ecosystem assessment (conducted for the U.S. Fish and Wildlife Service) of the South Fork Coeur d'Alene River watershed, focused on evaluating factors controlling wild trout production. Collected, analyzed, and developed habitat suitability (Category II) curves for brown and brook trout, bull trout, Chinook salmon, pink salmon, chum salmon, and steelhead trout. Invited participant in bull trout experts meeting to develop Habitat Suitability Curves (Category I) for bull trout spawning, juvenile rearing, adult holding, and fry. Organized and conducted three habitat suitability curve workshops designed to review and develop Category I curves for anadromous and resident salmonid species for drainages in Oregon and Idaho. Principal investigator of a microhabitat study to define habitat utilization of coho and Chinook salmon, and steelhead trout in the White River, Washington; data were collected by direct observation using snorkeling techniques.

Fish Passage: Awarded Outstanding Technical Paper award (Bechtel) for work involving the development of a procedure for assessing fish passage problems at low head hydro projects. Evaluated passage problems and barrier potential (Chinook salmon and steelhead) of the Lake Redding project in California. Developed conceptual designs of fish passage facilities for salmon (Atlantic salmon) at two hydro projects in Connecticut. Assessed barrier potential (Chinook salmon and steelhead) of falls in two Idaho streams, and formulated plans for removal of an abandoned power dam in the East Fork Salmon River drainage in Idaho. Designed barrier analysis study for potential flow-dependent barriers located in Ward Creek, below Connell Dam near Ketchikan, Alaska. Involved in the development of concepts for upstream and downstream fish passage (steelhead trout) on the Carmel River in California. Reviewed and assessed suitability of upstream and downstream passage facilities for the Milford Dam on the Penobscot River.

Book and Manuscript Reviews: Technical manuscript reviewer for Fisheries, Rivers, Transactions of the American Fisheries Society, North American Journal of Fisheries Management, and Environmental Management. Has reviewed technical reports for the U.S. Fish and Wildlife Service, U.S. Geological Survey, the U.S. Forest Service, National Marine Fisheries Service, and various State resource agencies. Member of the Editorial Board for "Rivers," a journal focused on addressing instream flow issues. Published several formal reviews of books in "Rivers" and "Fisheries."

SELECTED PUBLICATIONS AND TECHNICAL REPORTS

Reiser, D.W. 2008. Enhancing Salmonid Populations via Spawning Habitat Restorative Actions. 2008. Pp 349-376. In. D. Sear and P. DeVries, (eds). Salmonid Spawning Habitat in Rivers: Physical Controls, Biological Responses, and Approaches to Remediation. American Fisheries Society, Symposium Publication No. 365. Bethesda, Maryland.

Reiser, D.W., M. Gagner, C. Huang, T. Sullivan, S. Beck, T. Nightengale, and C. Morello. 2008. Determination and evaluation of habitat – flow relationships in the Sultan River, Washington.

Sultan River Instream Flow Study. Prepared by R2 Resource Consultants, for Public Utility District No. 1 of Shohomish County and City of Everett.

T.J. Sullivan, D. W. Reiser, M. Gagner, and S. M. Beck. 2008. Penny Creek fish passage feasibility study: Phase 2 – assessment of Penny Creek anadromous salmonid production potential and fish passage technical considerations. Report prepared for U.S. Fish and Wildlife Service, under contract to MWH Americas.

Reiser, D. W, T. Nightengale, N. Hendrix, and S. Beck. 2008. Effects of pulse-type flows resulting from hydroelectric operations on aquatic biota. Hydro Review. May Issue.

Reiser, D. W. 2007. Species distributions, life history strategies and habitat-flow requirements of anadromous salmonid populations in the Yukon River Basin, Alaska. Report prepared for the Native American Rights Fund. Anchorage, Alaska.

DeVries, P., D. Reiser, C. Huang, S. Beck, M. Ramey, A. Olson, N. Hendrix, K. Oliver, T. Nightengale, J. Reilly, T. Kenward, and M. Palmer. 2007. North Coast instream flow policy: scientific basis and development of alternatives protecting anadromous salmonids. Task 3 Report – Administrative Draft. Prepared for California State Water Resources Control Board.

Reiser, D. W., C. Morello, and A. Olson. 2006. Monitoring the Green River Natural Resource Area for salmonid utilization – 2005/2006 survey results. Report prepared by R2 Resource Consultants for City of Kent, Washington.

DeVries, P., D. Reiser, and N. Hendrix. 2006. Tests of regional Habitat Suitability Index curves: validation of Snake River Basin Adjudication curves with empirical data and comparison of curves developed independently for the Big Creek and Upper American River projects, Sierra Nevada, California. Technical Memorandum No. 2. Prepared for U.S. Forest Service, Fort Collins, Colorado.

Reiser, D. W., C. Morello, M. Gagner, and T. Nightengale. 2006. Fish, habitat, and benthic macroinvertebrate surveys of selected streams within the City of Kent, Washington. Technical Report prepared for City of Kent, Washington.

Reiser, D. W., C. Huang, S. Beck, M. Gagner, and E. Jeanes. 2006. Defining flow windows for upstream passage of adult anadromous salmonids at cascades and falls. Transactions of the American Fisheries Society; 135:668-679.

Beck, S. and D. Reiser. 2006. Monitoring of gravel quality in the Sultan River, Washington. Report prepared by R2 Resource Consultants for Snohomish County Public Utility District.

Reiser, D. W, T. Nightengale, N. Hendrix, and S. Beck. 2005. Effects of pulse-type flows on benthic macroinvertebrates and fish: a review and synthesis of information. Report prepared by R2 Resource Consultants for Pacific Gas and Electric Company, San Ramon, California.

Harvey, B., S. McBain, D. Reiser, L. Rempel, and L. Sklar. 2005. Key uncertainties in gravel augmentation: geomorphological and biological research needs for effective river restoration. Prepared by CALFED Science Program and Ecosystem Restoration Program and Gravel Augmentation Panel, Sacramento, California.

Nightengale, T., and D. Reiser. 2005. Comparison of benthic macroinvertebrates in spring- vs run-off dominated streams in the Upper Klamath Basin, Oregon. Report prepared by R2 Resource Consultants for Bureau of Indian Affairs, Portland, Oregon.

Nightengale, T., N. Hendrix, S. Beck, and D. Reiser. 2005. Macroinvertebrate data analysis for Tule River and Rock Creek-Cresta (FERC No. 1962) Projects. Prepared for Pacific Gas and Electric Company, San Ramon, California. Prepared by R2 Resource Consultants, Inc. Redmond, Washington.

Reiser, D. W. 2005. Instream flows for fish and aquatic biota: a review of technical considerations and commonly applied methodologies. Technical Paper, R2 Resource Consultants, prepared for Seattle City Light and Seattle Public Utilities.

Reiser, D. W., C. Morello, M. Appy, E. Jeanes, and A. Olson. 2005. Monitoring the Green River Natural Resource Area for salmonid utilization. Report prepared by R2 Resource Consultants for City of Kent, Washington.

Loftus, M.E., and D. Reiser. 2004. Evidence of Repetitive Spawning Activity of Lost River and Shortnose Suckers from USBR Radio-telemetry Studies, 1993 – 1999, Technical Memorandum; *in* R2 Resource Consultants. 2004. A compendium of technical memoranda related to water quality and shortnose (*Chasmistes brevirostris*) and Lost River (*Delistes luxatus*) suckers population demographics in Upper Klamath Lake, Oregon. Prepared for Bureau of Indian Affairs, Portland, Oregon.

Helser, T., M. Loftus, and D. Reiser. 2004. A Statistical Model of Upper Klamath Lake Adult Sucker Depth Utilization; Technical Memorandum; in R2 Resource Consultants. 2004. A compendium of technical memoranda related to water quality and shortnose (*Chasmistes brevirostris*) and Lost River (*Delistes luxatus*) suckers population demographics in Upper Klamath Lake, Oregon. Prepared for Bureau of Indian Affairs, Portland, Oregon.

Helser, T., M. Loftus, N. Hendrix, and D. Reiser. 2004. Risk Analysis of Unsuitable Dissolved Oxygen Concentrations in Upper Klamath Lake: Model Development and Application; Technical Memorandum; *in* R2 Resource Consultants. 2004. A compendium of technical memoranda related to water quality and shortnose (*Chasmistes brevirostris*) and Lost River (*Delistes luxatus*) suckers population demographics in Upper Klamath Lake, Oregon. Prepared for Bureau of Indian Affairs, Portland, Oregon.

Loftus, M. E., K. Oliver, and D. Reiser. 2004. An Evaluation of Water Quality in the Near Shore Areas of Upper Klamath Lake, Oregon; *in* R2 Resource Consultants. 2004. A compendium of technical memoranda related to water quality and shortnose (*Chasmistes brevirostris*) and Lost River (*Delistes*

luxatus) suckers population demographics in Upper Klamath Lake, Oregon. Prepared for Bureau of Indian Affairs, Portland, Oregon

Loftus, M. E., and D. Reiser. 2004. Estimating the Effect of Aging Uncertainty on Observed Fish Age-Frequency Distributions *in* R2 Resource Consultants. 2004. A compendium of technical memoranda related to water quality and shortnose (*Chasmistes brevirostris*) and Lost River (*Delistes luxatus*) suckers population demographics in Upper Klamath Lake, Oregon. Prepared for Bureau of Indian Affairs, Portland, Oregon.

Helser, T., and D. Reiser. 2004. Calculation of a New Relative Abundance Index For Klamath Lake Lost River and Shortnose Suckers Based on Female Spawning Reproductive Potential *in* R2 Resource Consultants. 2004. A compendium of technical memoranda related to water quality and shortnose (*Chasmistes brevirostris*) and Lost River (*Delistes luxatus*) suckers population demographics in Upper Klamath Lake, Oregon. Prepared for Bureau of Indian Affairs, Portland, Oregon.

Reiser, D. W., D. Chapin, P. DeVries, and M. Ramey. 2004. Flow regime and ecosystem interactions in spring-dominated streams: implications for selecting instream flow methods. Hydroecologie appliquee. Volume 1: pages 93-104.

Reiser, D. W., E. Greenberg, T. Helser, M. Branton, and K. Jenkins. 2004. In situ reproduction, abundance and growth of young-of-year and adult largemouth bass in a population exposed to polychlorinated hydrocarbons. Environmental Toxicology and Chemistry, Volume 23, No. 7.

Reiser, D. W., D. Chapin, and C. Huang. 2004. Ecosystem characteristics and flow regime interactions in spring-dominated streams: a synthesis of existing information relevant to streams in the upper Klamath Basin, Oregon. Prepared for the Bureau of Indian Affairs, Portland, Oregon.

Reiser, D. W., D.F. Woodward, E. Jeanes, D. Harper, A. Farag, and E. Connor. (in press). Defining the determinants of wild trout production in the South Fork Coeur d'Alene River, Idaho using a reference stream approach. Submitted to North American Journal of Fisheries Management.

Reiser, D. W., D. Chapin, P. DeVries, and M. Ramey. 2003. Flow regime and ecosystem interactions in spring dominated streams: implications for selecting instream flow methods. In Proceedings of International IFIM Conference, June 2003, Fort Collins, Colorado.

Demko, D., A. Olson, M. Simpson, G. Kopp, and D. Reiser. 2003. Acoustic tracking technology and potential applications for salmonid research within the San Francisco Bay and Sacramento- San Joaquin Delta. Prepared for California Urban Water Agencies, Sacramento, California.

Reiser, D. W., C. Huang, S. Beck, M. Gagner, and E. Jeanes. 2003. Assessment of instream flow alternatives for fish and aquatic habitat within Ward Creek, Alaska below Connell Dam. Prepared by R2 Resource Consultants for U.S. Forest Service, Ketchikan, Alaska.

Reiser, D. W., E. Jeanes, M. Gagner, C. Huang, S. Beck, and E. Greenberg. 2002. Assessment of fish and aquatic habitats potentially affected by the Whitman Lake Hydroelectric Project, Alaska.

Prepared by R2 Resource Consultants, for Ketchikan Public Utilities, under subcontract to WESCORP.

Greenberg, E., D. Reiser, M. Loftus, and W. Coughlin. 2002. Evaluation of largemouth bass habitat, population structure, and reproduction in the upper Housatonic River, Massachusetts. Prepared by R2 Resource Consultants, for General Electric Company, Pittsfield, Massachusetts.

Reiser, D. W. 2002. Effects of the White River Hydroelectric Project on water temperatures relative to Chinook salmon life history requirements. Prepared by R2 Resource Consultants for Lake Tapps Task Force and Perkins Coie, Bellevue, Washington.

Reiser, D. W. and K. Oliver. 2002. Review of projects employing conventional fish screens: existing information analysis. Prepared by R2 Resource Consultants, for Portland General Electric.

Jepsen, D. and D. Reiser. 2001. Fish passage existing information analysis for the Clackamas River Hydroelectric Project (Oak Grove Project – FERC No. 135 and North Fork Project – FERC No. 2195). Prepared by R2 Resource Consultants for Portland General Electric.

Kvam, B., E. Connor, E. Greenberg, D. Reiser, and C. Eakin. 2001. Lower Deschutes River macroinvertebrate and periphyton monitoring report, fall 1999 and spring 2000 sampling. Prepared for Portland General Electric. Prepared by R2 Resource Consultants.

Connor, E., D. W. Reiser, E. Greenberg, S. Beck, and K. Binkley. 2001. Fisheries study of Chester Morse Lake, Masonry Pool, and major tributaries of the Cedar River Watershed, Washington. Report prepared by R2 Resource Consultants, Inc. for Seattle Public Utilities, Seattle, Washington.

DeVries, P., B. Kvam, S. Beck, D. Reiser, M. Ramey, C. Huang, and C. Eakin. 2001. Kerr Hydroelectric Project Lower Flathead River ramping rate study. Report prepared by R2 Resource Consultants, Inc. for Confederated Salish and Kootenai Tribes of the Flathead Nation.

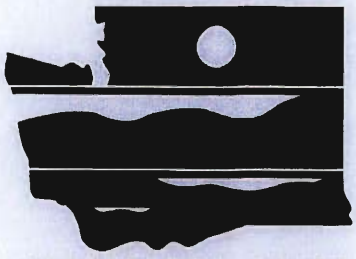
Reiser, D. W., M. Loftus, D. Chapin, E. Jeanes, and K. Oliver. 2001. Effects of water quality and Lake Level on the biology and habitat of selected fish species in Upper Klamath Lake. Report prepared by R2 Resource Consultants Inc. for Bureau of Indian Affairs, Portland, Oregon.

Ramey, M. P., D. W. Reiser, S. Beck, and C. Huang. 2000. Feasibility study for sediment bypass on Lee Vining, Walker, and Parker creeks, Mono Basin, California. Report prepared by R2 Resource Consultants, Inc. for Los Angeles Department of Water and Power.

Reiser, D. W., M. P. Ramey, and P. DeVries. 1999. Development of options for the reintroduction and restoration of chinook salmon into Panther Creek, Idaho. Pages 565-581 *in* E. Knudsen, C. Steward, D. MacDonald, J. Williams, and D. Reiser, editors. Sustainable Fisheries Management – Pacific Salmon. Lewis Publishers, Boca Raton, Florida. 724 p.

EXHIBIT:

Washington State Department of Ecology, *Waters Requiring Supplemental Spawning and Incubation Protection for Salmonid Species*



Waters Requiring Supplemental Spawning and Incubation Protection For Salmonid Species

Revised January 2011
Publication Number 06-10-038

As Described in:
The Proposed Water Quality Standards for Surface Waters of the State of Washington, Chapter 173-201A

Waters Requiring Supplemental Spawning and Incubation Protection for Salmonid Species

This publication is part of the Water Quality Standards for Surface Waters of the State of Washington (Chapter 173-201A WAC). The maps contained within this publication describe where and when additional temperature criteria are required to ensure protection for the incubation of salmon, trout, and char. Spawning information provided within this publication should be used in conjunction with other aquatic life use information provided in the surface water quality standards. Temperature criteria that apply outside of the spawning seasons can be found in Chapter 173-201A-600 and 602 (Table 602).

The salmonid populations targeted for the additional protection are those that have eggs and embryos developing in the stream bed in late spring to early fall. Salmonid populations which begin spawning in late fall or whose young have emerged from the stream gravels before late spring do not require added protection.

A spawning temperature of 13°C (as a 7-day average of daily maximum temperatures) is used to protect summer reproduction areas for salmon and trout, and a criterion of 9°C (as a 7-day average of daily maximum temperatures) is used to protect summer reproduction by native char species (bull trout and Dolly Varden). The following maps provide the locations where these criteria are to be applied along with the dates to which they apply.

The state is divided into Water Resource Inventory Areas (WRIA). These large watersheds aid in water management activities. Maps of each WRIA showing waters that require more protective temperature criterion make up the body of this publication. A statewide WRIA map is located in the front of this publication. ***(If there is no map for a given WRIA, this indicates there is no summer spawning data for that particular area.)***

Note: *The maps herein show only where and when supplemental temperature criteria are required to protect the summer season spawning of salmonids. For some of these waters more stringent year-round criteria (7-day average daily maximum of 12°C) must be met to protect use by native char. Refer to Chapter 173-201A-602 (Table 602) to identify where more restrictive criteria have been designated to protect native char (bull trout and Dolly Varden).*

EXHIBIT:

Federal Defendants' Reply in Support of Supplemental Cross Motion for Summary Judgment – NWF v. NMFS

DWIGHT C. HOLTON
Acting United States Attorney
STEPHEN J. ODELL, OSB #90353
Assistant United States Attorney
District of Oregon
600 United States Courthouse
1000 S.W. Third Avenue
Portland, OR 97204-290
(503) 727-1000

IGNACIA S. MORENO
Assistant Attorney General
SETH M. BARSKY, Section Chief
COBY HOWELL, Trial Attorney
MICHAEL R. EITEL, Trial Attorney
BRIDGET K. McNEIL, Trial Attorney
Wildlife & Marine Resources Section
U.S. Department of Justice
Environment & Natural Resources Division
c/o U.S. Attorney's Office
1000 SW Third Avenue
Portland, OR 97204-2902
(503) 727-1023 / (503) 727-1117 (fx)

Attorneys for Defendants

UNITED STATES DISTRICT COURT
DISTRICT OF OREGON
PORTLAND DIVISION

NATIONAL WILDLIFE FEDERATION, *et al.*,

Plaintiffs,

v.

NATIONAL MARINE FISHERIES SERVICE, *et al.*,

Defendants.

Civil No. 01-CV-640-RE

REPLY IN SUPPORT OF FEDERAL DEFENDANTS' SUPPLEMENTAL CROSS MOTION FOR SUMMARY JUDGMENT AND COMBINED OPPOSITION TO PLAINTIFFS' SUPPLEMENTAL MOTIONS FOR SUMMARY JUDGMENT

INTRODUCTION

In the 1990s, Judge Marsh reviewed a system that had very little spill, almost no surface by-pass, unfocused habitat mitigation, and, not surprisingly, very little agreement among the sovereigns in the region. While dissension and lack of mitigation marked that time period, it was underscored by 240 returning wild Snake River fall Chinook and one returning Snake River sockeye. Today, the preliminary estimate for returning 2010 wild Snake River fall Chinook is over 4000, and the count for returning Snake River sockeye was 1316.[1] The Nez Perce Tribe and other agencies recently completed their annual productivity survey of Snake River fall Chinook redds. They found 5,626 redds, exceeding the previous record by 1,910 (notably set in 2009). Other recent data suggest that for steelhead, juvenile hydrosystem survival is higher than ever before and the average travel time from Lower Granite to Bonneville Dam of approximately 18.4 days has been reduced by approximately 5.4 days as a result of structural and operational changes.[2] This Administration will continue to build on these successes, and our work is far from done, but Plaintiffs' arguments cannot change these numbers, what they represent, and how far the agencies have come from the system Judge Marsh once reviewed.

At each turn throughout this litigation we have welcomed the Court's review on all of the critical issues, opened up the technical aspects to independent science, and where there were recommendations grounded in data, the agencies created and implemented new measures. With this Administration's full support, the agencies have charted a course that is protective and that complies with the law. Operational advancements and habitat mitigation are working. Indeed, Plaintiffs have clarified that they do not seek a change in the extensive habitat projects that are being implemented over the next seven years; to the contrary, they would seek an injunction forcing the agencies to implement the very Reasonable and Prudent Alternative ("RPA") that we

[1] Although the final 2010 estimate is not complete, 42,700 Snake River fall Chinook (excluding jacks) returned to Lower Granite Dam and, historically, 10-20% of the run has been wild fish. *See http://www.cbr.washington.edu/dart/adult.html* (adult returns for 2010 to Lower Granite Dam) (last visited Feb., 8, 2011).

[2] *See* NOAA 2008 B.0538 at 87 (pre-RSW, TSW average); *compare*, http://www.nwcouncil.org/news/2010/10/9.pdf (last visited Feb., 8, 2011).

EXHIBIT:

Transcript of Cross Motions for Summary Judgment, *NWF v. NMFS* (March 6, 2009).

IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF OREGON

NATIONAL WILDLIFE FEDERATION, et al.,	)	
Plaintiffs,	)	CV No. 01-640-RE
vs.	)	March 6, 2009
NATIONAL MARINE FISHERIES SERVICE, et al.,	)	Portland, Oregon
Defendants.	)	

TRANSCRIPT OF CROSS MOTIONS FOR SUMMARY JUDGMENT

PROCEEDINGS

BEFORE THE HONORABLE JAMES A. REDDEN

UNITED STATES DISTRICT COURT SENIOR JUDGE

COURT REPORTER: Dennis R. Grube
1000 S.W. Third Avenue, Suite 301
Portland, OR 97204
(503) 326-8180

is throwing so much mitigation at these ESUs that we are halting the decline and we're placing it on upward trend. Now if we are going up, how are we reducing the likelihood of recovery. We're increasing the likelihood of recovery.

I'll move this along, Your Honor.

I just want to show you two things. The three states have come to you in their brief. They talk about our ESU by ESU approach where we focus on an ESU, and we figured out and we made a jeopardy determination with respect to each individual ESU. It's a very individualized process. And they did a great job of explaining that. That was a lot of work in the biological opinion.

Now, the plaintiffs have come to you and they have said every single one of those ESUs is arbitrary and capricious. You have not demonstrated that there's an appreciable reduction of likelihood of survival and recovery. They've said every single ESU is bad. The entire BiOp is bad.

I want to show you one ESU. These are recent numbers for Snake River Fall Chinook. And, unfortunately, these lines aren't showing up exactly clear. But there's a line right here, Your Honor. I'll admit Snake River Fall Chinook is doing great. That is a great ESU for us. It's one of our stars.

Mr. True has come to you and he says this

ESU is failing to meet the threshold of the ESA. That is his argument.

These right here, Your Honor, those are recent -- that's 2007, 2008. And they are preliminary at this point. They haven't been vetted throughout the whole process and they gotta undergo all that stuff. But they're not going to move very far.

This line, Your Honor, that's when they were listed. This line right here, that's the TRT minimum recovery threshold. So everything above that, according to the TRT, has recovered.

So for five of the six last years Snake River Fall Chinook has been over the recovery criteria.

I want to read you an e-mail that was sent -- that was sent around the region. It reads: The 2008 Fall Chinook salmon return to the Snake River is the largest we've seen since the Snake River dams were constructed and actual counts began in the 1960s. PS, This is a great year to be able to report on. I've also attached a picture from our red count slice on the Clearwater River. There are approximately 200 reds in the area the picture was taken. We've already counted 815 on the clear water with another month of spawning left compared to last year's record of 718 for the whole season.

Here's the picture, Your Honor. And I don't

EXHIBIT:

Columbia River Fall Chinook 2011 Preseason Forecasts, *U.S. v. Oregon* Technical Advisory Committee Sub-group (Feb. 28, 2011)

COLUMBIA RIVER FALL CHINOOK
2011 PRESEASON FORECASTS

Stock Group	2011 February Forecasts	2010 Actual Returns	2010 February Forecasts
Lower River Hatchery - LRH	133,500	103,000	90,600
Lower River Wild - LRW	12,500	10,900	9,700
Bonneville Pool Hatchery - BPH	116,400	130,800	169,000
Upriver Bright - URB	398,200	324,900	310,800
Snake River Wild - SRW*	17,500	15,400	5,300
Bonneville Upriver Bright - BUB	37,600	29,400	30,300
Pool Upriver Bright - PUB	62,400	49,600	42,300
Columbia River Total	**760,600**	**648,600**	**652,700**

*Subset of URB

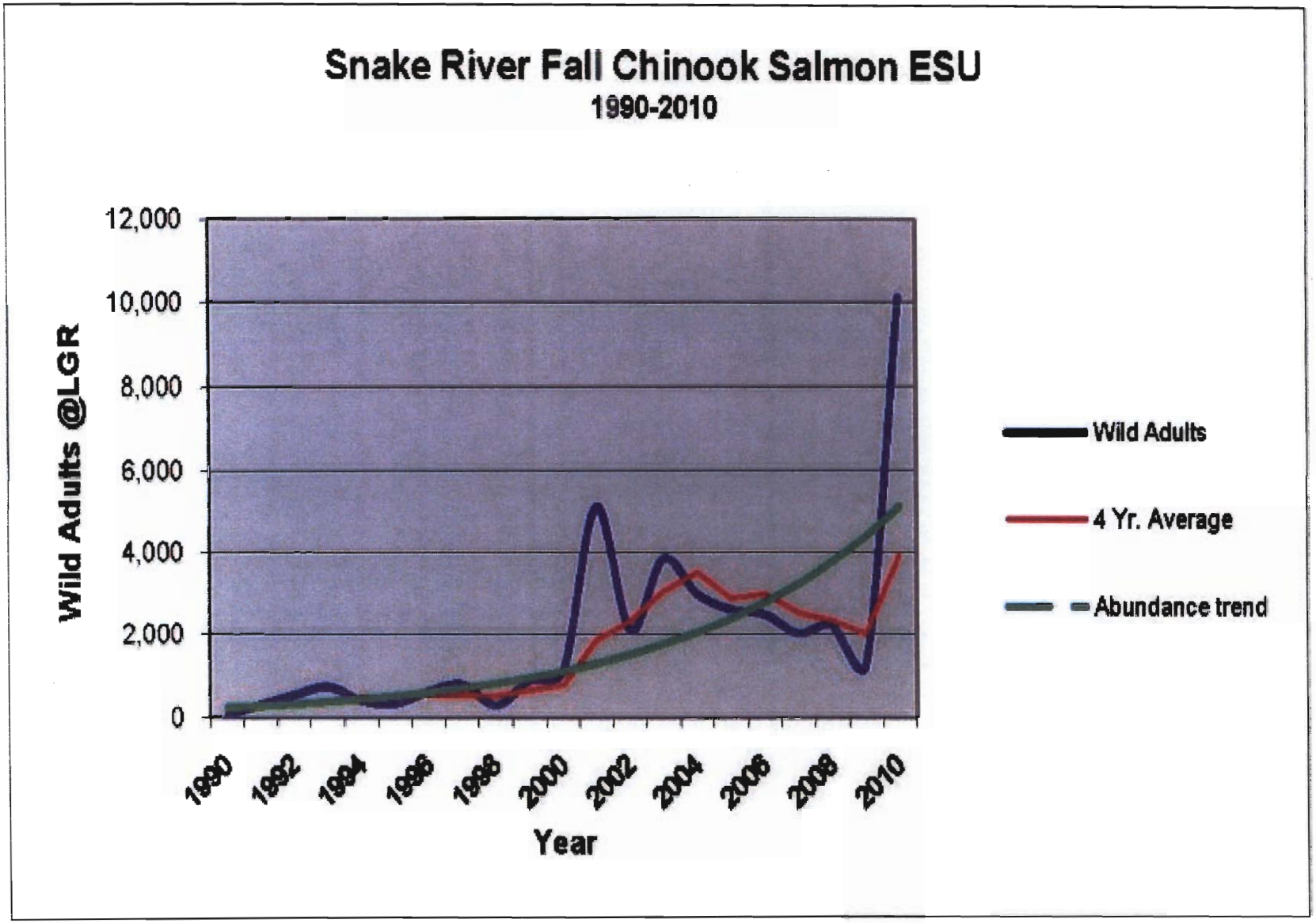
2011 Forecasts

- LRH - Best return since 2003 and greater than the 10-year average (92,500).
- LRW - Improved over last four years, but slightly below 10-year average (15,400).
- BPH - Slightly less than 2010 actual return but greater than the 10-year average (105,900).
- URB - 2nd largest return since record keeping began in 1964 (The largest return was 420,700 in 1987). Over 60% of the 2011 return is expected to be age-4 fish.
- BUB - Similar to the 10-year average of 47,500.
- PUB - 3rd largest return on record (1986). Greater than 10-year average (43,800).
- Total forecast of 760,600 Columbia River fall Chinook is the 5th largest since at least 1948 and greater than the 10-year average of 565,800.

February 28, 2011
Washington Department of Fish and Wildlife
U.S. v Oregon Technical Advisory Committee Sub-group

EXHIBIT:

Snake River Fall Chinook Salmon ESU – 1990-2010 Wild Adult Returns at Lower Granite Dam


Snake River Fall Chinook Salmon ESU
1990-2010
Wild Adults @LGR
12,000
10,000
8,000
6,000
4,000
2,000
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
Year
Wild Adults
4 Yr. Average
Abundance trend