Report of the Independent Scientific Advisory Board

Review of a Draft Programmatic Environmental Impact Statement: **Impacts of Artificial Salmon and Steelhead Production Strategies in the Columbia River Basin**

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for the Northwest Power Planning Council
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Origin and Objectives of the DPEIS

The draft programmatic environmental impact statement (DPEIS), *Impacts of Artificial Salmon and Steelhead Production Strategies in the Columbia River Basin*, was prepared by the Columbia Basin Fish and Wildlife Authority (CBFWA) for the U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), and Bonneville Power Administration (BPA) in order to assess the current use of artificial production and to assess how well artificial production has met the objectives for which it was established (p. 6; DPEIS). Another stated impetus for developing the DPEIS was the issue of genetic protection for naturally producing stocks of salmon and steelhead and concerns that interactions with hatchery produced fish might be eroding the long-term fitness of naturally spawning stocks (p 21; DPEIS). Finally, the DPEIS, which recognizes that current fisheries management focuses primarily on artificial production to meet harvest needs (p. 7; DPEIS), attempts to provide guidance on whether, and in what direction, to modify present artificial production programs in the Columbia River Basin.

ISAB Assignment

The draft Programmatic EIS is an important document in the Basin, because the USFWS, NMFS, and BPA intend to use the final Programmatic EIS to guide development of an overall federal strategy for artificial production of anadromous fish in the Columbia River Basin (p. 14; DPEIS). Due to the potentially important role that the final programmatic EIS can play in the future direction of artificial production and salmon recovery within the Basin, NMFS (letter from Will Stelle to Rick Williams, Chair, ISAB) and the Northwest Power Planning Council (NPPC) (letter from John Etchart to Chip McConnaha, NPPC staff and ISAB liaison) requested the Independent Scientific Advisory Board (ISAB) to review and provide comment on the scientific and technical aspects of the draft programmatic EIS.

Summary of the ISAB Review

Normally, an Environmental Impact Statement assesses the impacts on the environment of alternative actions, balanced against benefits and costs. The DPEIS identifies six management alternatives. Expected costs and benefits of the alternatives are not quantified. We were unable to find in the DPEIS an assessment of the current status of artificial production, an assessment of whether, or to what extent, artificial production has achieved its historical goals, nor an assessment of genetic effects (potential and realized) of artificial production of salmonids on wild fish. As for costs, the DPEIS in Appendix C (Pacific Northwest regional economic elements affected by fish hatchery management decisions) states that because the EIS does not

quantify biological outcomes associated with the six management alternatives, it cannot quantify the economic consequences. Consequently, the DPEIS focuses on outcomes without making a cause and effect connection with actions that might lead to them.

The DPEIS suffers from substantial flaws in analysis and logic that prevent the document from achieving its stated objectives. The DPEIS and its appendices (A-C) are technically incomplete, beyond which, the DPEIS main text reaches conclusions or inferences that are not supported by the findings in its own limited technical appendices. The DPEIS does not thoroughly analyze the impacts (biological, economic and social benefits and costs) of the management alternatives it presents, as is required of an Environmental Impact Statement. Because of these shortcomings, the DPEIS cannot adequately guide future program development for artificial production in the Columbia River Basin.

The Independent Scientific Group's report 96-6, *Return to the River*, specifically called for a comprehensive review and evaluation of the artificial propagation program in the Columbia River Basin (pp. 402-404). Unfortunately, although the objectives described above by the DPEIS outline such a review, the DPEIS does not accomplish that review. Nor does it appear likely that minor revision of the DPEIS can lead to a final EIS that meets the objectives identified in the DPEIS.

Recommendation

A comprehensive and technically complete evaluation of artificial production in the Columbia River Basin (mainstem and tributaries) is needed, which the DPEIS did not accomplish. The evaluation should include the historical and present role of artificial production including all current aspects of artificial propagation (e.g., production, supplementation, IHOT, etc.). The evaluation should address the historical and present interaction between harvest management and artificial propagation. It should also present and rigorously analyze management alternatives (biologically and economically) in order to stand as an EIS.

The region would benefit from a comprehensive evaluation of the impacts (biological, economic and social benefits and costs) of artificial production. In turn, the evaluation would provide guidance on the future roles and appropriate scale for artificial production programs in the Columbia River Basin. Consequently, until a comprehensive review and evaluation of artificial production has been completed, new investment in artificial production programs and facilities, as recommended by the DPEIS preferred alternative, seems unwarranted.

General Comments on the DPEIS

1. *The DPEIS is not in agreement with findings of other recent reviews of salmon hatchery programs.*

We were unable to find support for the DPEIS statement (DPEIS pp. 6-7, 14) that its conclusions reinforce findings from several other recent substantive hatchery program reviews. In fact, the conclusions of the DPEIS are in conflict with other important reviews of artificial production, including the National Fish and Wildlife Foundation's (1994) *Report of the National Fish Hatchery Review Panel*, the National Research Council's (1996) *Upstream: Salmon and Society in the Pacific Northwest* and the Independent Scientific Group's (1996) *Return to the River*. In general, these reports recommend reducing the overall scale of artificial production, placing greater emphasis on natural production and the rebuilding of depressed wild stocks, and reducing interactions and impacts between wild and hatchery stocks. For example, the NRC report strongly discourages the notion of using hatcheries to provide salmon for harvest unless there is very high confidence in the ability of fishers to separate hatchery and wild fish. The NRC report specifically recommends against outplanting where there is a chance of hatchery-wild matings in upstream areas: "more distant, upstream wild populations should be conserved even if their presence complicates efforts to keep hatchery fish separated from wild fish" (NRC 1996; page 321). Furthermore, the NRC report states that "any hatchery that 'mines' broodstock from wild (natural) spawning populations should be a candidate for immediate closure…" (NRC page 322). All of these conclusions differ from either the specific recommendations or general tone of the DPEIS, but are in agreement with the recommendations of the National Fish Hatchery Review Panel (1994) and the recent ISG report (1996) *Return to the River*.

2. *The DPEIS needs to provide a quantitative assessment of artificial production (Objectives 1 and 2 above)*

It is well known that in general hatcheries have failed to meet their historical and mitigation[1] objectives (NRC 1996; ISG 1996). If, after 120 years of artificial production in the Basin and 50 years of mitigation for the effects of the hydropower system, it is not known why hatcheries have failed to meet their objectives, that lack of knowledge should point to a need for improved monitoring and evaluation of the hatchery program. Without that knowledge, how is it

[1] Here we use the term "mitigation" to mean compensation for an impact "by replacing or providing substitute resources or environments." The definition, which has been adopted by the US Fish and Wildlife Service, comes from the National Environmental Policy Act regulations (40 CFR Part 1508.20(a-e)) and was cited in the Federal Register, Vol 46, No. 15, January 23, 1981.

possible to predict the effects of additional hatchery production? In addition to understanding why and to what degree hatcheries have failed in general, we also need to know specifically if some hatcheries have successfully met their mitigation requirements and what factors might have contributed to their success.

a. Historical objectives of artificial production.

The DPEIS does not adequately identify the origin and purposes of existing hatchery programs, including the Mitchell Act, the Lower Snake River Compensation Program, and details of the Columbia River Fish Development Project such as John Day Dam mitigation, and other elements that affect hatchery production of salmon and steelhead (e.g., the Management Plan adopted in U.S. v. Oregon and Washington). The attempt to use artificial propagation to mitigate for the effects of mainstem dams in the Columbia Basin now has a 50 year record. In order to assess the historical efficacy of artificial production in the Basin, the DPEIS should have included an analysis of the 50 year mitigation experience, including at a minimum:

- A list of mitigation hatcheries and their adult production targets;
- The record of returns for each facility compared to the mitigation target;
- For those facilities that have failed to meet their mitigation objectives, the DPEIS should include an explanation for the failure and the research/management steps that have been taken to correct the problem.

b. Artificial production as a mitigation tool.

Among the primary objectives for which artificial production was established, was the need to compensate for lost or degraded habitat, bolster depleted runs, and provide surpluses of fish for harvest (pp. 11-12; DPEIS). Mitigation was not specifically examined in either the technical appendices or in the main DPEIS text.

While the DPEIS avoided analysis of individual hatcheries, the efficacy of hatchery mitigation is a programmatic question that needs to be addressed in an EIS and will require examining information from individual hatcheries.

c. Current status and contribution of artificial production.

The current role of artificial production in the Basin, as well as its potential contributions to harvest or other aspects of the fishery, need to be provided in the DPEIS in quantitative terms. In addition to the information listed above, the following factors should be included in an analysis of the current role of artificial production:

- Annual operating costs for each hatchery;

- Current production levels;
- Associated costs of transportation;
- Survival rates of downstream passage; and
- Adult return rates, including returns to offshore and river fisheries.

The preceding information was not provided in the DPEIS.

d. Artificial production as a recovery tool for ESA stocks.

There is no explanation given as to why the default decision under uncertainty is to increase the extent and intensity of hatchery operations. The DPEIS acknowledges that there are many credible hypotheses of mechanisms whereby the hatchery production in the Columbia basin could have negative effects on wild salmon production. However, it concludes from its review that available data and analyses to date are insufficient to prove or disprove these hypotheses at a level of certainty that would justify action. On the basis of this claim of inconclusive scientific evidence, it seems unwarranted that the DPEIS recommends adoption of a plan of action that expands hatchery production and shifts the emphasis of the program into the upper basin tributaries.

3. *The DPEIS limited its analysis to the mainstem, while the preferred alternative primarily affects upriver tributaries.*

There is a serious distortion in limiting the analysis to hatchery-wild interactions in the migration corridor, but then reaching some rather sweeping generalizations with regard to the basin's hatchery programs as a whole. The study was limited to impacts that occur in the mainstems of the Columbia and Snake rivers. Specifically eliminated from consideration were local impacts (e.g. carrying capacity in a particular subbasin for both hatchery and naturally populations), hatchery operations, mainstem passage, and harvest. The preferred alternative examined in the DPEIS would shift supplementation from the current level of 7 million smolts to 78 million smolts, an increase of more than 1100%. Because the proposed massive increase in supplementation would be carried out in the tributaries, the preferred alternative recommends actions that are clearly beyond the scope of the mainstem-oriented analysis. Most of the research that characterizes interactions between hatchery and natural salmon has been carried out in the tributaries. Impacts in the mainstem, which have been little studied, may be irrelevant given the magnitude of impacts in the tributaries. What are the magnitudes of mortalities due to hatchery-natural competition experienced in the mainstem relative to those experienced in the tributaries? If this question is not answered, how can the decision to exclude tributary effects be explained?

The DPEIS Executive Summary justifies limiting the focus to interactions in the mainstem Columbia and Snake rivers by saying that hatchery operation guidelines are covered by IHOT, habitat restoration programs are "beyond this evaluation's scope", and "concerns regarding competition, disease and predation *in tributary streams* are necessarily left to site-specific impact assessments." Despite these caveats, the preferred action alternative makes some rather specific recommendations pertaining to just these topics. All five of the recommended actions (p. 5; DPEIS Executive Summary) have important implications that go beyond mitigating interactions between hatchery and naturally-produced salmon and steelhead in the mainstem rivers, including shifting the emphasis of supplementation from the lower to upper river and tributary streams and establishing an "enhanced natural production objective" (not defined). These conclusions are not technically supportable, given the data presented.

4. *The DPEIS needs to adequately address the subject of interaction between harvest management and hatchery production in impacting natural stocks*.

Although the DPEIS acknowledges that the hatcheries were built, and are operated, to serve harvest management regimes, it sidesteps harvest management issues. Salmon cannot continue to survive in the Columbia River basin above Bonneville without substantial changes in the natural-cultural system that includes hatcheries and harvest management regimes (see extended discussion and recommendations in NRC (1996) and ISG (1996) reports). The DPEIS states there is a lack of "direct evidence" that hatcheries, in and of themselves, have inflicted genetic and ecological damage on salmon bearing ecosystems. The DPEIS mentions, but does not address, the historical facts regarding the role of the hatchery-harvest system in the extirpation of natural salmon species above Bonneville Dam, and in the attendant alteration of salmon species and life history composition.

5. *The DPEIS needs to assess the genetic and fitness effects of hatchery fish on natural populations (Objective 3 in the DPEIS above).*

The report does not adequately address the substantive evidence for deleterious genetic changes caused by some (currently used) hatchery practices in combination with fishing effects and habitat loss. Numerous references exist in the primary fisheries literature that document to one degree or another genetic changes associated with hatchery and wild fish interactions (Leary *et al*. 1984; Campton and Johnston 1985; Utter *et al*. 1989; Currens *et al*. 1990; Gall *et al*. 1992; Utter *et al*. 1993; Campton 1995; Leary *et al*. 1995; Utter *et al*. 1995; Williams *et al*. 1996). Many of these citations are missing from the DPEIS main text and from the technical appendices.

Those studies that have rigorously examined ecological (Fausch 1988), behavioral, (Swain and Riddell 1990; Fleming *et al*. 1996) and genetic (Verspoor 1988; Hindar *et al*. 1991;

Waples 1991; Dowling and Childs 1992; Philipp *et al*. 1993; Leary *et al*. 1995; Philipp and Clausen 1995) differences between hatchery and naturally-produced fishes in the Columbia Basin and elsewhere have shown reduced fitness in the natural stock after interaction with the hatchery stock. Reisenbichler and colleagues (Reisenbichler and McIntyre 1977; Reisenbichler and McIntyre 1986; Reisenbichler and Phelps 1989; Reisenbichler *et al*. 1992; Reisenbichler 1995; Reisenbichler 1997) present evidence that fitness of steelhead in the Columbia basin was reduced after only one generation of hatchery propagation and could be as much as *halved* after two generations, relative to naturally-produced fish.

6. *The DPEIS needs to adequately survey the pertinent fisheries and ecological literature on many topics*.

The DPEIS needs to enlarge the scope of its review of the literature as indicated in the previous comment. Other examples of omissions include papers by Flagg et al. (1995), which documents the role of hatcheries in the near extirpation of native coho salmon populations in the lower Columbia River, as well as key papers on new roles for hatcheries (White *et al*. 1995), and a suite of papers that discuss the many uncertainties associated with supplementation (Bowles and Leitzinger 1991; Hilborn and Winton 1993; Bowles 1995). The DPEIS also is missing key references on northern squawfish predation (Beamesderfer *et al*. 1990; Rieman and Beamesderfer 1990; Beamesderfer and Rieman 1991; Poe *et al*. 1991; Rieman *et al*. 1991).

7. *Issue of "proof" versus weight of evidence and strong inference*

The DPEIS overlooks a substantial body of scientific knowledge on wild and hatchery fish interactions by basing its conclusions only on those factors said to offer "clear proof" or "direct evidence" of interaction between wild and hatchery fish. As previously noted, the DPEIS based its conclusions on the analysis presented in its technical appendices (A-C). However, because these analyses were limited to only those factors said to offer "clear proof", as well as the fact that analysis of interactions in the tributaries was excluded from consideration, the DPEIS paints an inaccurate and overly simplistic picture of wild and hatchery fish interactions.

A careful reading of the literature on many issues described in the DPEIS, such as carrying capacity, behavioral interactions, genetic interactions, fitness effects, etc., reveals that a large body of literature exists on many of these topics (including many key references that are not cited in the DPEIS). Without knowing what criterion the DPEIS used to establish what is proven, it nevertheless appears to us that the accumulated weight of evidence in the literature can lead to compelling inferences about relationships, biological effects, and predictions about management actions (see discussion of genetics and fitness effects in Point 5 above). The DPEIS

needs to consider the weight of evidence and inferences that are possible from the literature on most aspects of wild and hatchery fish interaction.

8. *The DPEIS needs to address the fundamental questions on artificial production.*

The DPEIS states that it is not possible to draw meaningful conclusions about the potential for harm to the wild salmon from their analyses. The hypotheses of various mechanisms for harm are not new. Much time and much money has been spent on studies that allegedly were intended to address these questions. The DPEIS needs to analyze why these past investigations have not been conclusive, and then propose a preferred alternative that includes explicit designs and funding levels for further studies that would be adequate to resolve the critical questions about potential harm to endangered stocks. These questions need to be resolved before it is reasonable to contemplate an expansion of the hatchery effort.

9. *An alternative hatchery program for salmon recovery.*

The conclusions of the DPEIS calling for an expanded hatchery program are not supported by its own analyses (Appendices A and B) nor by the general fisheries and ecological literature. Other alternatives are not analyzed in detail. Several recent reviews (National Fish Hatchery Review Panel 1994; ISG 1996; NRC 1996) present an alternative approach to hatchery practices in the Basin. This approach, described below, is more consistent with the technical appendices in the DPEIS, than is the main text of the DPEIS.

Recovery and restoration of depressed Columbia Basin salmon stocks will be assisted by a hatchery program that focuses on the maintenance of endangered stocks, or the temporary reintroduction of local fish into empty habitat, with hatcheries focused on producing harvestable fish only in those areas where the risk of competition with natural stocks is minimal and the harvest is clearly restricted to that hatchery stock. All hatcheries should use stringent guidelines for stock selection, release timing, and other operations that can cause negative interactions with natural stocks.

10. *The DPEIS needs to include an Economic Impact Assessment that identifies and analyzes the costs and benefits associated with the management alternatives specified in the EIS.*

The standard expectation of an economic analysis embedded in an EIS is that it be an Economic Impact Assessment (EIA) that provides both the public and decision makers a systematic economic analysis of the alternative actions under consideration. The purpose of an EIA is to identify and analyze the costs and benefits associated with alternative actions specified in the EIS. A comparison of marginal changes associated with the alternative actions clarifies the

economic tradeoff between actions to the extent possible. The usual format of an EIA is to describe the status quo (baseline), quantify the relevant variables using the best available data, and analyze the likely impacts (benefits and costs) on various sectors of each alternative action. The analysis is often accompanied by a specification of the risks or levels of uncertainty associated with each alternative. Areas of data inadequacy are also identified.

Appendix C is not an EIA. The authors state that because the EIS does not quantify biological outcomes associated with the six alternatives, the economic consequences cannot be quantified. However, the report could have laid out the economic issues associated with each alternative, presented data where available, identified areas of missing data, and guided readers through a systematic examination of the economic tradeoffs associated with the alternatives. Instead, the information that is presented is extremely general, undocumented in important areas, and not directly related to the six alternatives contained in the DPEIS.

The first section of Appendix C presents a framework for examining the potential economic consequences of increasing the productivity of habitat and fish populations. The framework is so general it is irrelevant to the alternatives under consideration in the EIS. It begins with a particular outcome and works through the potential effects of that outcome. It is not useful or relevant to base the discussion on a particular outcome when the issues under analysis are the differences in outcome that may result from alternative actions.

The words "fish" and "habitat" are used as general descriptors, preventing consideration of the substantive issues related to hatchery management alternatives: distinctions between wild and hatchery stocks, genetic diversity, fish behavior, fish health, or approaches to habitat alteration. Each of these issues have associated benefits and costs, which should have been addressed in the report.

The second section of Appendix C presents a general history of salmon fisheries in the PNW. It is not clear what direct relevance the discussion has to the EIS, unless it is to provide context for the assessment of hatchery policy effects. From the policy perspective, what are relevant are marginal changes in value associated with the alternative actions. Decision-makers are often interested in these changes from two perspectives:

1. What are the distributional effects of a particular action?
2. What are the changes in society's net benefits that result from a particular action?

These distributional and net benefit questions of the proposed actions could have been addressed by the report, if only in a qualitative way.

The report advances the argument that "quality of life", expressed in fishery-related amenities, will increase the attractiveness of the PNW as a place to live, pulling labor into the region and fueling economic growth. This connection is extremely tenuous, but if this line of argument were to be followed it should at the minimum examine the effect the resulting

population increase will have on demand for hydropower, consumer goods and environmental services that may compete with fishery-related environmental amenities. More importantly, the discussion is irrelevant to the DPEIS to the extent that it has not been related to the alternatives under consideration.

The report also presents a discussion of subsidies. There is little argument among economists about the distorting effect of subsidies but if subsidies to the power, DSI's, agriculture and timber industries are under discussion, the same examination will have to be given to hatcheries. No mention of subsidies to hatcheries was made.

The final section of Appendix C contains a list of conclusions and recommendations for further evaluation. Several conclusions are so general as to be meaningless. Others are not supportable by evidence presented. Recommendations for further evaluation are not well-connected to hatchery issues. Overall, Appendix C is neither an adequate discussion of economic issues related to hatchery management nor an impact assessment of alternative actions presented in the DPEIS.

Specific comments on the DPEIS

1. *Lack of correlation between the technical appendices and the main DPEIS text*.

The "data" of this DPEIS are the literature review of potential impacts of hatchery fish by Witty et al. (Appendix A), the analysis of exposure of naturally produced migrants to hatchery smolts (Appendix B), and the analysis of economic elements affected by fish hatchery management decisions (Appendix C). The DPEIS states this in Chapter IV (p. 98-99), where the analytical methodology is presented. These "data" can be compared to statements about the affected environment in Chapter III, and about the environmental consequences of hatchery operations, especially the preferred alternative, in Chapter IV. The ISAB was struck by the poor correlation between statements in the appendices, especially in Appendix A, and the text of the DPEIS, in spite of the stated dependence noted above. Statements made quite strongly about current effects of hatchery fish in Appendix A were missing or much watered down in the text. We find this to be misleading. Several examples are listed below:

a. <u>Competition in mainstem reservoirs:</u> The summary of current interactions on p. 82 does not include the conclusion from Appendix A, p. 12, that, "Increased hatchery smolt production in the Snake River basin would increase risk of impacts to natural fish while decreased smolt production would reduce risks." In contrast, the corresponding paragraph in the text

concludes with, "However, there is no data to demonstrate whether smolt performance and survival is affected because of inadequate food supplies (Muir and Coley 1994)." The reader is left with an impression opposite to that of the conclusion of the appendix review.

b. Competition in the estuary: The summary of current interactions on p. 82 of the text also does not include the fairly strong statement of the appendix (p. 16) that, "We determined that competition may occur between juvenile natural and hatchery salmon and steelhead in the Columbia River estuary." The text says, "While competition may occur between juvenile natural and hatchery salmonids in or immediately above the Columbia River estuary, few studies have been conducted to evaluate the extent of the problem (Dawley et al. 1986)." The appendix, however, reviewed several studies that concluded an increase in competition from hatchery fish and it provided a summary evaluation table by species and time for management and further evaluations (p. 18). The main text is misleading.

c. Competition in the ocean: The appendix reviewed several studies of density dependence in fish survival in coastal waters and the ocean, and emphasized that studies of competition are inextricably linked with harvest. It reported that, "(we) conclude that large increases in smolt emigration result in negative impacts from increased harvest rate. ... Therefore, impacts which may result from competition in the ocean and impacts which result from ocean harvest appear to respond in a parallel manner to changes in numbers of smolts emigrating from the Columbia River system." In contrast, the text says that, "Competition in the ocean is also related to harvest, and to the number of smolts entering the ocean from the estuary. However, very little information is available on either subject. To date, research has not demonstrated that hatchery and naturally spawning salmonids compete in the ocean (references omitted)." Certainly, this is not a fair representation of what was given in the appendix.

d. Predation: The appendix goes beyond the summary of squawfish predation given in the text (which states that prey densities at which consumption is highest have the greatest effect on naturally produced smolt survival) to give more detail about effects of different density ranges. The text gives a misleading impression that not much is known.

e. Straying: The text fails to give the concluding statements of the appendix: "Impacts from potential straying and interbreeding must be assessed from a review of management and hatchery practices and from a review of prevailing environmental conditions that may contribute to straying. (Five common factors of current hatchery operations are listed that

increase straying). A preponderance of these factors in a production scenario contributes to the risk of impacts from straying."

2. *The "analytical tool" of Appendix B.*

The "analytical tool" presented in the DPEIS is a very simple model for quantifying the number of downstream migrating hatchery smolts to be expected at various locations and times. The model does not directly speak to any of the hypothesized mechanisms of potential harm to wild salmon and steelhead, and it seems irrelevant to some of them (genetics, interactions in the ocean). In this light, the "tool" seems to have been somewhat oversold in the executive summary.

3. *The DPEIS assumes that IHOT guidelines are adequate to guide the conversion of production hatcheries to supplementation and conservation hatcheries.*

The DPEIS (pp. 17 and 33) assumes the IHOT (Integrated Hatchery Operations Team) guidelines will be adequate to guide the conversion of production hatcheries to supplementation and conservation hatcheries, but shows no analysis to justify that assumption. We are skeptical of the efficacy of IHOT guidelines without some justification.

4. *Hatchery goals and habitat restoration.*

The DPEIS (p. 33) states that meeting hatchery production goals depends, in part, on efforts to restore and protect habitat. No analysis is offered to suggest that habitat will be restored and protected. This is especially critical if the preferred alternative is accepted. That alternative would increase releases in the tributaries from 7 to 78 million smolts. The success of those plants will depend heavily on the quality of the habitat and the current seeding levels. Assuming that habitat will be protected is ironic since the assumption that artificial propagation would mitigate for lost habitat contributed to the degradation of habitat in the first place.

5. *Inaccuracies with respect to the Mitchell Act (p. 18; DPEIS).*

a. Not only was it the case that the implementation of the Mitchell Act, "may have modified some stocks." (DPEIS at p. 18), it profoundly altered the species composition and life history type composition of the Columbia River basin. The criterion in selection of salmon species and life history types for propagation under the Mitchell Act was commercial desirability (see DPEIS page 18). As the primary instrument of compensation for human development of the Columbia River basin, the Mitchell Act not only potentially modified the stocks which were included in the hatcheries, it had profound effect on those species and stocks that were excluded.

b. The statement that the "hatcheries supplemented stocks lost (due to elimination of habitat} ... primarily for the purposes of maintaining sufficient numbers for harvest." is factually inaccurate and contradictory of statements elsewhere in the DPEIS. The Columbia basin hatcheries substituted other salmon species and stocks returning to other localities than the species and stocks lost to habitat elimination. The lack of in-place in-kind mitigation (prior to the 1960s) contributed to the lowering of salmon species richness, and may have lowered genetic diversity as well. These activities do not constitute supplementation, as it is currently defined and used in the Basin (RASP Guidelines1992). Similarly, the outplanting of 78 million smolts into upper basin tributaries as recommended by the DPEIS's preferred alternative appears to constitute production, not supplementation.

The DPEIS uses the term supplementation with respect to a number of different fisheries management objectives (e.g., harvest augmentation, restoration, and "supplementation" in the sense of RASP 1992). Confusion about the term "supplementation" led the NRC report (1996) to recommend that the term be dropped from usage. The ISAB supports the ISG's previous recommendations (SRG Report 91-1, *Review of Supplementation*; ISG Report 96-6, *Return to the River*) that the term apply only to those activities described and guided by RASP (Regional Assessment of Supplementation Project, 1992)

6. *Predation hypotheses (p. 83; DPEIS).*

The DPEIS completely missed the impact of predator swarms created in response to mass releases of hatchery juveniles into the mainstem Columbia River (Collis *et al*. 1995). Massing of predators for glut feeding on juvenile hatchery salmon poses a significant risk to any natural populations because of concentration of predators and support of predator populations by hatchery production. This should be part of any predator hypothesis for the mainstem, and for the tributaries as well. Appendix A also missed this.

7. *Questionable citations.*

Why was Readers Digest cited (DPEIS; p. 69) as a source for the prediction that mainstem dams would abolish the salmon fishery and not published scientific papers which are readily available.

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