Methow Subbasin Summary

APPENDIX D – KEN WILLIAMS' REVIEW OF WASHINGTON STATE CONSERVATION COMMISSION. SALMON STEELHEAD AND BULL TROUT HABITAT LIMITING FACTORS, WATER RESOURCE AREA 48. FINAL REPORT

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I have reviewed a document that contains no title page, date, or author identification. Stamped on the first page is RECEIVED, JUN 15, 2000, OKANOGAN COUNTY COMMISSIONERS. The introduction reveals that the report is "a compilation of information regarding known habitat conditions in the Methow watershed (WRIA 48) pursuant to the Conservation Commission's limiting factors project in accordance to the Salmon Recovery Act under the Engrossed Substitute House Bill 2496". Informally this report is known as the "Limiting Factors" report, and, indeed, this best defines what the report attempts.

Summary of Review

The goal of determining the limiting factors of habitat in the Methow watershed is a daunting task in the short time that was allotted. The authors deserve credit for covering a tremendous amount of ground quickly. Good work always comes with a rigorous review of the literature, and the number of citations listed is impressive. They produced an exhaustive list of potential habitat limiting factors and that is of great value to get the ball rolling to the next step—sifting through the list to find those that have merit.

On the negative side, the stated goal of listing habitat conditions implies listing the positive, unique conditions as well as the negative ones, which was not attempted. The author (s) do not identify themselves. There is no acknowledgement statement, so it's impossible to determine if the report has been peer reviewed. Though literature citations were profuse, their use often was careless, incomplete or skewed to help support the authors' unrelenting attempt at validating limiting factors on their list. Objectivity is sacrificed from the authors' heavy reliance on generic theory, idealistic models, and professional judgement. Cause and effect is seldom achieved. The sections dealing with historical and fish distribution and status are distorted to dramatize the plight of salmonid runs.

The authors have taken license from their mandate to record every conceivable factor which <u>might</u> limit fish. Even had the authors carefully articulated a warning to this approach, which they have not, the risk of publishing the report and casting it into concrete in its present form would facilitate the transformation of <u>potential</u> limiting factors to <u>actual</u> limiting factors, further muddling the already hopelessly confused effort to restore fish runs. Therefore, this report should not be published as it now stands. The speculation from professional judgment needs to be replaced by meticulous, balanced study regardless of how much time or money it takes. The reworked report then needs careful peer review. Only then can this work contribute substantively to fisheries science and avoid itself from becoming a limiting factor to fish restoration. I offer my critical review with the goal of helping improve this work. The authors should not lose sight of my intent or that I'm on their side.

In my opinion the three major areas emerging from this analysis needing better understanding are: (1) the extent to which irrigation diversion affects natural runoff patterns, water temperature, chemical enrichment, and fish production; (2) the role that large woody debris played historically in producing fish; (3) the affect of man's placement of 35 miles of riprap on fish production.

Below is my paragraph by paragraph review and comments. I start with the executive summary and end with the fish distribution and status section.

Executive Summary (9 pages)

Paragraph 2, p 1 of 9.

No distinction is made between hatchery and natural adults. If hatchery origin steelhead are considered, then where is the severe decline in adults? Steelhead spawning escapements are meeting the Maximum Sustained Yield (MSY) escapement level most of the time if hatchery spawners are included (Mullan et al. 1992, Appendix H). As recent as the early to mid-1980s, 20,000 steelhead passed Wells Dam and the Methow River became the top summer steelhead river in Washington, based on angler harvest. Following this period of super abundance, steelhead runs have declined universally even in Canadian wilderness coastal streams that have not been subjected to habitat degradation, harvest, or domestication. The authors imply that the "severe" decline is peculiar to the Methow and that it is unprecedented, a grave misrepresentation of reality. There were years in the early 1800s before settlement when salmon and steelhead runs failed in the mid- and upper Columbia River and local Indians were reported as starving by passing explorers (Mullan et al. 1992).

A better way to express the status of salmon and steelhead runs is that natural runs cannot sustain themselves any longer without hatchery supplementation.

As for bull trout, the dramatic decline in adult numbers is unsupportable because there are <u>no</u> historical run estimates to compare with today's runs (spawning escapements). Considering that bull trout are apex predators and that their critical spawning and initial rearing habitat represents only 1.2% of the Methow basin, just how abundant do the authors think they were?

To be consistent, NMFS examined the status of summer chinook in the Methow and did not list them because they determined the runs to be stable. The authors seem bent on showing fish abundance in the worst possible light.

Paragraph 3, p 1 of 9

It blocked all fish but chinook salmon were passed over because hatchery personnel in that era prized this species above all others (Mullan et al. 1992).

Paragraph 3, p 1 of 9

This is a poorly worded sentence. A better way to say it would be—in 1939, a massive hatchery program was launched to mitigate production loses above the impending Grand Coulee Dam.

At least up until 1955, long after the hatchery programs started and folded, steelhead runs were not only sustaining themselves they were healthy. It wasn't until the 1960s when hydropower development was completed that the natural runs became unsustainable—hint, hint.

This sentence reveals that this report is likely to be defined by platitudes. All of the oft-repeated limiting factors are re-presented once again without any insight into assigning weight to individual factors. Moreover, the authors seem unaware that there is a battle raging over whether instream habitat is a significant limiting factor, or they do not find the controversy important, or they are trying to suppress the debate. Their selective use of the literature clearly shows that they believe that the crown jewels of recovery are found in refurbishing Methow habitat. That any serious, balanced discussion of limiting factors would be attempted without comprehensive reference to Chapman et al. 1994 (steelhead), Chapman et al. 1994 (chinook), Mullan 1987, and Mullan et al. 1992 is incomprehensible and derelict.

Paragraph 4, p 1of 9
Such credulity. What is there about habitat parameters that habitat biologists find so empowering that they are willing to make the leap from perceived habitat condition to fish sustainability in quantitative terms? All models to date have had their problems, and without site-specific testing, the results are mere guesses fraught with the possibility of ridiculous error. The classic local example is Caldwell and Catterson's (1992) IFIM results, which call for flows greater than the Methow can provide even in pristine condition. Yet the establishment scientist myopically ignores other evidences and hangs on tight to that study despite its neon flaws (detailed below). Each scientific entity dances to the beat of its own drums (e.g., mandate, source of funding, power base, constituency, agenda, leadership, protocol etc.) unwittingly funneling analyses to narrow, predictable, self-serving outcomes. Considering the myriad of scientific entities each voicing its own interpretation, one understands with clarity the overwhelming confusion surrounding fish restoration today. These authors, obviously, view the limiting factors question through a habitat straw which invariably leads them to the inescapable conclusion that the road to delisting must travel through habitat restoration.

Paragraph 1, p 2 of 9
This paragraph is staggering, but at least the authors are forthcoming about their limitations. Said with more clarity, the paucity of data forces them to use their professional judgment, which means that this analysis is reduced from science to art and that we can trust them because they are professionals! In effect, unwittingly or not, the authors have told us that this analysis will not answer adequately the question at hand—is habitat significantly limiting salmonid production in the Methow?

I'm puzzled that the authors lament that data are extremely limited regarding private lands. They seem unfamiliar with the work of Mullan et al. (1992) who conducted multi-disciplined research from the mouth at Pateros through the private reaches of the mainstem Methow and all of the major tributaries through public domain to alpine meadows. Those authors examined all known limiting factors on five fronts—ethno-historical review, current fish abundance, historical trends of abundance, species interactions, and habitat attributes and status—and employed multiple technologies, which is why they called their report Monograph 1. If the authors feel that Monograph 1 is flawed, its sheer magnitude demands that they explain how it's deficient and why the reader should reject it in favor of their conclusions. Remaining silent reduces the value of their work.

One strength of Monograph 1 is that it approaches the habitat and fish status question through the "front door", that is, they let the fish tell them about their status and the condition of habitat via production outputs that are measurable quantitatively. It follows that their spawner-recruit analysis is the method of choice to determine run status. That explains why NMFS and USFWS did not go out and measure habitat to ascertain the sustainability of the runs and whether they should be listed. The use of habitat to say things about fish status or sustainability features the "back door" approach, and the stumbling block of this strategy is that it requires the additional step of correlating habitat attributes with fish abundance. That confidence limits do not accompany attempted correlations show that man cannot define habitat and/or reliably measure it. Therefore, inferences about fish even from the most precise habitat measurements frequently miss the mark. Inferences based on professional judgement are worse. If one wants to determine habitat productivity ask a fish not the habitat.

So why doesn't the biologist always choose the front door (some measure of fish production) approach? Fish are difficult to enumerate and it's much easier to measure habitat. Habitat models, therefore, represent seductive shortcuts. Models, also, feature the irresistible feature of predicting fish responses to altered habitats (e.g., flow change). Predictive models can be useful if they are calibrated to a given site. That Caldwell and Catterson 1992 failed to calibrate their model speaks to the difficulty of calibration and to results that are equivocal. For this reason IFIM model outputs are unsuitable for setting minimum flow (Armour and Taylor 1991).

The authors claim expertise for themselves, but what confidence ensures that these people possess <u>enough</u> expertise to enable them the incredible ability to "look and tell". We don't even know their identity! Have the authors immersed themselves into the Methow to reconcile theory with reality? My own transformation from theorist to biologist after taking the plunge was so overwhelming that I cannot fail to challenge the acuity claim for professional judgement about habitat/ fish relationships. Who could rationally opt for a professional judgement given the spawner-recruit curve in Monograph 1 showing a healthy population of steelhead between 1941-55, when habitat conditions were almost certainly worse than what exists today, and contemporary steelhead smolt production that approximates the MSY level? Until habitat-limiting proponents coherently respond to these findings and other compelling information presented below, their arguments ring hollow.

Paragraph 2-3, p 2 of 9
The authors make some good points here.   And I must, at this point, state that though my reluctance to accept the power of habitat analysis to answer fish status questions is vehement, it's unquestionable that habitat is an essential component of fish productivity. Further, just because I remain unconvinced that habitat has not been significantly degraded in the Methow does not mean that I don't recognize the potential for habitat degradation and the uncompromising need to safeguard it.

Paragraph 4-1, p 2 of 9 and p 3 of 9
This treatment of limiting factors outside of Methow basin is egregiously trivializing and points again to the authors' eagerness to return to their habitat degradation theme. To do this one must be willing to skirt a mountain of serious science. Volumes have been written on the crushing affects of hydropower on anadromous salmonids. Mullan et al. (1992) make a quantitative case that hydropower <u>alone</u> accounts for the unsustainability of steelhead.

Paragraph 2, p3 of 9
Natural limitations are trivialized. The list of influences that reduce water temperatures not only affect growth and activity but survival as well. The longer an anadromous fish stays in freshwater the higher the mortality rate. At an average winter mortality of 60% one can appreciate the huge numerical advantage afforded steelhead reared in the Methow mainstem at Carlton (average smolt age 2 years) versus smolts reared in Early Winters Creek (average 4 or 5 years).

A platitude common for the Methow and endorsed by the authors is that factors which induce higher temperatures are categorically negative. If much of the basin is too cold, which is true, then warming in certain reaches might increase productivity.

The limiting affect of annual spring runoff is glossed over. Large woody debris is naturally limiting in degrading reaches because high water velocity escorts even the largest trees to the Columbia. A common index to fluvial productivity is the ratio of spring flow to summer low flow, and the most productive streams are spring-origin streams, which fluctuate not at all. The Methow enjoys no such stability, and its productivity suffers accordingly. The authors find virtue in annual flooding.

Natural dewatering occurs annually even in years with normal flows.

Most importantly no reference is given that cover is naturally limited. I have already mentioned the natural paucity of LWD in the degrading mainstems. In aggrading reaches cobbles and boulders are scarce. Reaches sparse in cover support meager populations of salmonids, particularly age-1 and older fish. Mullan et al. (1992) believed that cover became increasingly limiting for juvenile salmonids as they grew in size. Period epic floods militated against riparian development and stability along the Methow mainstem.

Absent is any mention of chemical paucity—namely nitrogen deficiency—owing to the basin's granitic geology.

Paragraph 3, p3 of 9
My familiarity of fish abundance in the creeks listed as being negatively affected by humans compels me to object. I presume their contentions will be illuminated later and so will mine, but for now I believe that the alleged problems are theoretically perceived (professional judgement) rather than actual (did anyone get into the water and determine fish densities). The statement that degradation extends into the upper reaches of Cub, Boulder, and Falls Creek is moot because barrier falls on these creeks historically precluded utilization of all but the lower reaches by the listed species in question.

Consistent with the habitat biologist's bent for only seeing the dark side of human interaction with streams, the authors fail to recognize a single positive. This clashes with the findings in Monograph 1, which credited humans with chemical enrichment, increasing cover via streambank armoring with angular rock (riprap), and the possible improvement of summer low flows with leaky irrigation ditches filling streamside aquifers for immediate and delayed recharge. Since the authors cites Monograph 1 elsewhere, they are aware of it; therefore, either they did not carefully read it or simply chose to ignored parts of it they disagree with. In either case their scientific credibility plays center stage again, since real science follows the trail of truth by sifting through all available information, whether it's agenda friendly or not. If the authors do not agree with Monograph 1 they need to explain why not only for their own edification but for that of the general public, many of whom are fully aware of the chasm between Monograph 1 and establishment science.

Paragraph 4,1, p3-4
The authors find themselves neck-deep in quicksand with the list of five conditions that they deem essential for listed species to achieve sustainability. Setting science aside for the moment let me say that I believe that my scientific opinion is unmatched based on 28 years of unbroken tenure in Okanogan County with the tri-discipline role of fish manager, habitat biologist, and researcher with the Washington Department of Fish and Wildlife. If my professional opinion (and others) diverges from the authors then the interpretation of limiting factors is reduced to the pitiful position of dueling professional opinions with no legitimate reference point for resolution. Both fish and people deserve better—quantifiable science.

Point 1 says that no further reduction in habitat quality and quantity is permissible if fish are to be sustainable. This report makes no attempt to qualify and quantify the habitat in the Methow and how habitat has changed over time? They make no attempt to correlate habitat with fish sustainability. The problems run deeper than the admitted snapshot nature of this effort, which is nothing more than the cataloguing of perceived habitat problems viewed one dimensionally from a habitat perspective without careful historical or contemporary review of available literature. Mullan et al. (1992) showed that listed anadromous salmonids in the first 40 years of the 20th

century sustained themselves even under severe harvest rates (approaching 90%) in the lower Columbia, before irrigation ditches were screened, before hatcheries supplemented, before the dam blocking the lower Methow mainstem for 16 years was removed, and prior to enactment of any semblance of environmental or fishery protection within the Methow basin. My question is this, why should we expect that current runs could not sustain themselves with some habitat reduction, given the wholesale correction of the gallery of horrific past abuses and stringent rules and regulations administered by a herd of biologists of every conceivable description? Current juvenile steelhead production approximates the MSY level, which is far above sustainability, indicating much room for habitat reduction, given the goal of mere sustainability. As for bull trout, what evidence shows that habitat problems affect them even slightly? There is utterly no scientific basis for the authors to claim that Methow basin habitat productivity has fallen significantly below natural levels or that the current unsustainability of chinook salmon and steelhead are connected to instream habitat condition.

Point 2 calls for the removal of unnatural fish barriers and installation of approved fish screens. I question the accuracy of the criteria used to determine whether passage is truly obstructed and whether impacts are real or perceived. If 2,200 steelhead spawners are needed for full seeding, what number of that total would be denied access by the artificial structures currently in place? The standard seems to be accessibility 365 days a year instead accessibility when fish are actually moving. Virtually every culvert is considered a fish barrier. Specific comments will be addressed in a case by case manner later.

Unscreened or purported substandard screens are often over-villainized. The National Marine Fisheries Service's (NMFS) recent injunction to dewater a ditch found to have "taken" 34 age-0 steelhead and 3 age-o spring chinook behind what they considered a substandard screen illustrates the point. When these fry were age-corrected to adult age, the claimed significant "take" actually rounded off to zero adults for both species.

Just because some fry can be found behind screens does not mean they would have survived in the river. Survival in large degree is a function of seeding (density dependent), and when capacity is exceeded extra fry disappear naturally because they cannot find a suitable territory. Using lethal means to remove all fish from study reaches within the Icicle Creek bypass, Mullan et al. (1992) found that the treated (barren) reaches soon "refilled" with the downstream drift of juveniles searching for territories. That is why spawner-recruit curves flatten off on top when capacity is met. Since escapements of steelhead adults have commonly reached the requisite 2,200 number for full seeding, surplus fry exist to counter unnatural losses. That the revolving monsters suck hapless fry into insatiable throats of hell is mostly an emotion evoked among the innocent. More likely the fry voluntarily probes seams around the screen in a desperate attempt to find a territory from which it may derive a living free of belligerent cohorts nipping its fins. Underseeding reduces the struggle for territories and fry are not so apt to be forced into marginal habitat and fish screens. This is why survival is higher in underseeded years, all things being equal. Smolts are seldom found behind screens because they outmigrate during robust flows of spring runoff following the main current away from diversion intakes. Again, Mullan et al. (1992) showed that wild steelhead runs were healthy from 1941-55 when screening was incomplete and archaic by today's standard.

Point 3 indicates that fish sustainability depends upon rehabilitation of habitat in certain lower reaches of tributary streams and portions of the mainstem. I have participated in 101 standing crop population estimates employing snorkeling, electro-fishing, and sodium cyanide techniques in the difficult-to-sample large tributaries and mainstem plus literally hundreds of hook and line fishing excursions in nearly every type-3 or larger creek within the Methow basin. Further, I have measured habitat attributes over the entire basin from the valley bottoms inhabited by humans to headwater streams still fresh from their points of pristine origin, where man is only a summer tourist. This experience and familiarity of the historical literature give me a unique understanding of the relationship between fish and habitat and what types and quantities of habitat were found in the basin before anglos arrived. It is my considered opinion that the authors' perception of Methow habitat is rooted in textbook idealism rather than basin-specific reality. As perceived abuses against attributes considered essential for optimum habitat mount and diminish attribute values below some unstated notion of a utopian standard, red flags are hoisted signifying that fish runs are unsustainable—it's the habitat stupid.

Such distortion is not new to the Methow, for the IFIM study (Caldwell and Catterson 1992) used a reference point of perfect flow to show that there was indeed a flow problem and that the fish needed more water than God chose to provide (pristine, natural flow). Deceptively, the problem perceived from the disparity between perfection and pristine natural is not blamed on God but man. Therefore, the current restoration blitz blindly charges ahead to change irrigation practices oblivious to other possibilities and consequences. Anticipated gains from NMFS' closure of the Skyline Ditch should be tempered by the fact that some wells betwixt ditch and river are now sucking air and that streambank aquifers, charged by ditch flow since spring runoff when river flow was excessive, will no longer discharge water back into the river during summer low flow but suck river water back into itself.

This report offers a similar seduction—habitat idealism over pristine natural. The romanticism with LWD is understandable; it's highly visible, publicized, and function-intuitive. When the uninitiated face a straight, pooless, side-channeless, riparian-barren, and LWD-less river that rushes seaward in one extended riffle, the twin emotions of melancholy and anger are generally evoked, rooted in the assumption that the environment has been degraded by man. But LWD is a naturally limited component of habitat in degrading reaches of the Methow basin, especially in the mainstem with its "hard" banks and voluminous, purging spring flows (Hillman et al. 1989, Spaulding et al. 1989). One must distinguish between the high-energy (degrading) Methow and low energy (aggrading) coastal lowland streams where large accumulations of LWD may occur (Sedell and Luchessa 1981). Long monotonous reaches of boulder/riffles typify natural conditions for many local streams. The perception of sequential ratios of idyllic pools and riffles is mostly romantic fantasy. The Methow and its tributaries have few side-channels and flood plains and exhibit little sinuosity because the river is mostly and naturally confined in steep banks or narrow valleys.

The preeminence of rocks in providing superb habitat for all salmonids, especially steelhead and bull trout, is underrated. Mullan et al. (1992) publicized the primacy of rocks but many “think with their eyes” to believe that the austere, monotonous boulder-riffle reach could not be prime habitat supporting maximum numbers of salmonids.

Not only that, but they bow to the unwritten tenet of habitat analysis that honors all things natural and condemns all things artificial. For this reason streambank failure along agricultural land or roadways is erosion whereas natural mass slope failure in pristine wilderness is recruitment of gravel, boulders, and large woody debris. Agricultural practices that add nitrogen and phosphorous cause eutrophication whereas release of the same chemicals from decomposing salmon carcasses is natural fertilization. Natural rock riprap from talus slopes shouldering mountain streams stabilize streambanks whereas man-placed riprap hardens banks, allegedly degrading productivity 7 different ways. Natural streams are in continuity with groundwater but irrigation ditches coursing through the same substrate leak into black holes.

The Methow basin supports 35 miles of riprap, which represents a substantial increase in habitat (Monograph 1). Though the authors later cite Don Chapman Consultants 1989 (Hillman and Chapman 1989) to show that juvenile chinook and steelhead depend on boulders from October to March (key winter habitat), they neglect to mention that those boulders were <u>artificial riprap</u>. Rocks, both natural and artificial, are a key habitat component of the mid-Columbia tributary streams for all species in all seasons. This information will not be found in textbooks or manuals; it’s found under the surface hidden in the cracks and crevices. The most abundant fish species in the Methow, the longnose dace, is virtually unknown to anglers or biologist because they spend their entire lives buried in the substrate. I was clueless for my first 15 years as the Area Biologist, and it wasn’t until sodium cyanide was used for sampling that the truth was uncovered. The primacy of rocks as premium habitat for interior North American salmonids has been grossly overlooked and is the last great frontier for habitat discovery. This delayed discovery is due mostly to overestimating the power of snorkel technology for quantifying fluvial salmonids because this method invariably underestimate abundance, especially in cold water (Mullan et al. 1992). Because rocks are submerged and less visual, even the professional eye is drawn to the high profile accumulations of LWD. That the authors only mention rocks obliquely or negatively demonstrates a major weakness in evaluating habitat.

The authors should follow their own warning stated in the middle paragraph of page 2. They should also consider that those same stream functions that purportedly need rehabilitation were operating when (1941-55) 2,200 steelhead spawners produced 7, 200 recruits on average.

Point 4 pinches the nerve of fish restoration theology in the Methow more than any other issue. Are leaky ditches asset or liability? The battle lines have formed and it’s Monograph 1 against establishment science (IFIM analysis). The authors have tacitly sided with the latter without elaboration. Local citizens have rallied behind Monograph 1 and are using it to obstruct implementation of establishment restoration actions. The establishment’s response was to contract the American Fisheries Society (AFS) to review Monograph 1 in an obvious attempt to dispose it. This unprecedented action is inappropriate and the result (August 2000) equivocal because of the impropriety of the establishment—and there can be little doubt that most western members of AFS are inextricable bound to establishment views and cognizant of Columbia basin restoration issues—reviewing what they themselves label as an anti-establishment report. That three of four reviewers disagreed with Monograph 1 is the expectation; that one reviewer agreed with Monograph 1 is the surprise, given the bias soil from which the reviews emerged. Conspicuously absent from review was establishment science. Monograph 1 is held to the highest scientific standard while establishment science is protected from any form of scrutiny. I underscored this hypocrisy and exposed the deficiency of establishment science (IFIM study) in a letter addressed June 6 (2000) to Dr. Tim Quinn, Chief Habitat Scientist, of the Washington Department of Fish and Wildlife (WDFW). How would this limiting factors report with its wholesale reliance on subjective professional opinion fare under intense rigorous review? I advised the NMFS this May (2000) of the flaws that invalidate the IFIM study in response to their injunction against the Methow Valley Irrigation District (MVID). Now I reiterate these flaws in this review.

The use of IFIM was not designed as the definitive answer (minimum flows) to disputes of flow, but rather a framework for negotiating what flows to implement (Armour and Taylor 1991). Lamb (1989) concludes his paper by stating that there is no one best way to perform instream flow analysis. One basic problem with IFIM is that there is no correlation of Weighted Usable Area (WUA) with some measure of fish abundance. Without confidence limits there can be no trust in the validity of results. The obvious cure for this problem is testing the model by measuring the response of fish standing crop against changes in WUA, but this was not done. So did the theoretical decline in fish density actually occur or did the fish persist until irrigation was terminated in October? Mullan et al. (1992), who compared fish densities between regulated and unregulated reaches, showed that the fish were persisting, not disappearing. Will it be untested theory or empirical data?

A basic tenet of accepted scientific experimental design is to include control study sites to test the possibility that the affects attributed to irrigation do not occur in the reaches upstream of irrigation. The absence of controls invalidates testing the premise that irrigation has altered or reduced summer low flow and WUA. If the IFIM study had been conducted in 1492 what would the result have been? Later I will introduce some new compelling historical evidence that indicates that WUA would have been even lower before irrigation development.

One of the criticisms of Monograph 1 is inadequate peer review yet the IFIM study had <u>no</u> peer review.

The IFIM study was conducted at the wrong time of the year, as low flow does not occur in the summer but in the winter, months after irrigation. Again we see the natural versus artificial bias with the illogic that affects during low artificial flow somehow exceed affects during the lowest natural annual flow. But the universal bottleneck for salmonid production is winter (Hunt 1969, Seelbach 1986, Griffith 1987).

Mullan et al. (1992) were confounded with the obvious contradiction about how a river could yield healthy wild steelhead runs when 80% of the summer base flow was diverted for irrigation. Recharge from leaky ditches was their deduction, owing to the narrow valleys and the porous substrate overlying bedrock, precisely the geologic prescription for recharge. According to establishment science, spring runoff flooding that recharges streambank aquifers is a natural virtue but the irrigation ditch that leaks into the same aquifers is artificial vice. The addendum to Caldwell and Catterton (1992) showed a 92% accounting at the Twisp gaging station for upriver irrigation flows returned to the river at the conclusion of the 1991 irrigation season, precisely the expectation given the number of ditches located above Twisp and their aquifer-priming affect months before low summer flow. By stark contrast, the Methow below Carlton has relatively small amounts of irrigation water adjacent to the river channel, and only 36% of the water measured at Twisp reached Pateros because the added water defused into the streambanks. The actual gain in water to Pateros was substantially overestimated because the added flow from the cessation of irrigation in Libby and Gold Creeks, the shut down of many pumps, and diminished evapo-transpiration rates was not subtracted.

The literature corroborates Mullan et al. (1992). Salmonid populations are greatest in streams that receive high ground-water input, which stabilizes base flows and water temperatures, and promotes greater water fertility (Hendrickson and Doonan 1972, White et al. 1976, Meisner et al. 1988). In arid regions, riparian vegetation may depend on ground water as well. Washington examples that link open ditches with increase discharge of groundwater include the Yakima (Vaccoro 1986a, 1986b) and Dungeness Rivers (Drost 1989). Irrigation in the South Platte River, Colorado transformed the pristine natural river from a intermittent, sparsely vegetated stream to a perennial stream whose channel stabilized, narrowed, developed sinuosity, and blossom with riparian vegetation (Silkensen 1993). Winter high flows are being diverted via irrigation ditches to flood irrigation lands adjacent to the Umatilla River to test whether low summer flows can be boosted and cooled. Preliminary results from this five-year study find that recharge is occurring 4 to 6 months latter and lowering the temperature 8^{o}F (Fred Ziari, IRZ Consulting, pers. comm.). He warns that converting ditches to pipelines potentially put the irrigation district at litigation risk from reduced recharge. The failure of wells near the inactive Skyline ditch is the handwriting on the wall.

What does the historical record have to say about low flows in the Methow BEFORE the irrigation ditches? The Mullan report, published in 1992, found no records to answer that question. But since then new historical information has emerged that sheds insights on some key questions concerning habitat and flow conditions in times past. Recently I discovered a voluminous (more than 2,500 pages) compilation of historical information entitled Methow Valley Pioneers by Dale and Olive Mae Dibble that contains the historical “smoking gun” supporting the Mullan report’s conclusion that pre-irrigation low flow might well be lower than post-irrigation low flow. Vernon LaMotte, mining engineer, geologist, and apple-grower who still lives in Carlton, had this to say,

> My father told me on October 12, 1908, he waded across the Methow River at Silver (between Benson and Beaver Creeks) in six-inch shoes and didn't get his feet wet. This was before our ditches from the river were in operation. This tells me that the river flows more now during the low water period than before the ditches started to flow.

Seemingly on every front the evidence mounts to support the obvious conclusion that irrigation is boosting low flows. The authors and fish agencies should understand that there is more at stake than who's right or wrong, for there's a stiff penalty for being wrong and that penalty is sacrificing the fish that they are entrusted to steward. Doing their homework goes beyond silencing their critics and defending the agenda. The penalty also takes on a libelous tone, since the issue has been presented to them directly with clarity.

The establishment's preoccupation with faulting irrigation misses the important benefit of ameliorating the adverse affects of flooding by diverting water from the mainstems, in a role not dissimilar to the dampening affect of the natural dissemination of water throughout the floodplain.

Most troubling to me with the IFIM study is the inappropriate application of the results that use perfect flow instead of pristine natural flow as the reference point. Doing so invariably manufactures a flow problem, since few rivers exhibit perfect flow patterns. The disparity between perfection and pristine natural is cunningly laid on humans. The IFIM study does not demonstrate that WUA has been reduced by irrigation. Mullan et al. (1992) found no flow pattern difference between regulated and unregulated streams, except in the immediate vicinity of the diversion site, which represents only 3% of the Methow basin. Large, pristine, unregulated, undomesticated watersheds in Idaho located upstream of 8 mainstem dams exhibit steelhead spawner-recruit curves identical to the Methow curve (Alan Byrne, Idaho Fish and Game, pers. comm.), offering a powerful argument that factors other than irrigation are limiting steelhead. For Mullan et al.(1992) and Idaho the answer is hydropower development.

Lastly, a lone study seeking to find answers within itself operating in a vacuum of knowledge outside of the ecosystem context such as this IFIM study trivializes unspeakable complexity and falls woefully incomplete in diagnosing a meaningful approach to restoration (Lichatowich et al.1995). The prophetic words of James Schlesinger, who exposed the improbability of system analysis to successfully aid decision makers due to bias (data, methodologies, and organization) and politics (Lamb 1989) could not be more relevant or penetrating.

TAG's Recommendations Ranked in Order of Importance

1. <u>Protection of properly functioning habitat</u>.

This whole point is unsupportable and wild speculation. The TAG desperately needs to produce some evidence of habitat dysfunction. Singling out the upper Methow as the reach in most need of protection is curious, because I believe that intense protection should be extended to the entire watershed used by listed species. The authors seem to infer that reaches not previously studied are not candidates for serious protection.

2. <u>Restoration of fish passage and screening of water diversions</u>.
The authors say the passage problem is critical but they advise study of available habitat above the barriers, an obvious oxymoron.

3. <u>Restoration of stream functions in the lower 15 miles of the Twisp River</u>.
The connection between the decline of spring chinook spawners and habitat in the Twisp River is bogus. The condition of the lower Twisp has not degraded in the time frame in question. Redd counts have declined in part because twice (1996 and 1998) fish managers intercepted all spring chinook arriving at Wells Dam and placed them in hatcheries. The reduction trend in spring chinook in the 1990s is a universal phenomenon observed for nearly all anadromous salmonids, including those in other subwatersheds with the Methow basin. Using the authors' logic of connecting redd counts with habitat condition, this year's large run of spring chinook must be attributed to an improvement of the habitat of the lower Twisp.

4. <u>Development and implementation of water conservation practices</u>.
Statements are speculatory platitudes that I have already debunked. In the end the authors confess that more information is needed to determine whether reduced flows are the result of nature or man-caused, the uncertainty of which destroys the critical nature of their proposed actions. All of the conditions described date back many years to the time of healthy wild runs.

Summary of Habitat Conditions by Subwatershed
<u>Upper Methow River Subwatershed</u>
I'm unconvinced that humans are significantly affecting the productivity of this reach. The authors seem to assume that where there is human activity negative impacts are obligatory. Don't we have effective environmental laws and the personnel to administer and enforce them? The productivity of alluvial fans is poor due to unstable flow and ephemeral, wandering, braided stream channels. The channelized alluvial fans are seen as detrimental, yet NMFS insists that the streambed in lower Wolf Creek is not narrow and deep enough for spring chinook passage and they are demanding that the Wolf Creek Reclamation District channelize further.

What's wrong with lower Goat Creek? The last time I conducted a standing crop estimate there (RM3.0) resident steelhead production was good.

I'm unaware of any bank destabilization problem that the authors unconvincingly tie to residential and agricultural development. Secondly, erosion rate is low, not leading to significant impacts to habitat or fish. Bank destabilization and channel widening date back to the 500 year flood of 1948 (Jerry Sullivan, local eyewitness, pers. comm.). There is no mention of bank stabilization from riprap placement, and the attendant benefits to survival for salmonids using this key but limited type of cover.

The authors subjectively talk about the amount of LWD, but this is academic for the reach from Robinson Creek to Weeman Bridge because of natural dewatering. Nothing is said about the natural paucity of boulders, which is a primary limiting factor for salmonids below Weeman Bridge.

There is no passage problem in the dewatered reach. Fish evolved to cope with temporal dewatering by migrating when flows are adequate; give micro-evolution and the fish some credit.

Lost River Subwatershed

Is the conclusion about the unnatural disappearance of LWD based on a historical background check or by comparison with LWD abundance upstream above the influence of humans? Being familiar with the full length of the Lost River and its LWD loading and distribution, I would not expect to find much LWD in the lower mainstem. Apart from a massive logjam wedged in the narrow channel atop the thunderous canyon below Diamond Creek, LWD is generally low in a river that has not been altered by humans. The pool/riffle ratios do not improve upstream above the influences of man, which leads me to believe that the assertion that human activity is responsible for a reduction of pool habitat is supposition. The dike in the lower Lost River occurs at the junction of upper Methow River and lower Lost River valleys where the broad river channel minimizes channel constraint. No mention is made of the benefits incurred from the riprap application in the lower Lost River.

Early Winters Subwatershed

According to the authors human impacts are most associated with riprapping and channelizing the alluvial fan. Considering the adverse conditions stemming from the instability of creeks naturally flowing across alluvial fans, what can be so detrimental with a consistent stream channel armored with riprap? Again we see the authors' fidelity to cast all human activity in darkness. Gravel scour is of consequence only if gravel is limited upstream. Healthy natural streams are mixes of scour zones and deposition zones. Deposition zones provide spawning gravel and the scour (boulder-riffle) zones offer cover and food. To illustrate my point, standing crop estimates of salmonids for 100 meter sections at RM 0.0, 1.5, and 5.0 was 2.3, 1.1, and 2.3 g/m^2, respectively (Mullan et al. 1992). The two upper sites were both above irrigation diversion and the alluvial fan and yet they show no higher densities.

Chewuch River Subwatershed

Again we have bold statements about human impacts that limit salmonids without supportive empirical evidence. The upper 50% of the basin purportedly is functioning well, but is that view based on reality or the fact that humans are absent from the upper regions (Pasayten Wilderness)? The upper Chewuch (above Thirty Mile Bridge) has few beaver and meager LWD accumulations, and less than that I've observed between Lake (RM23) and Andrew Creeks (RM25).

Catastrophic sedimentation? The authors overpower with sensational over-statement. If today's sedimentation level is catastrophic what would the authors term sedimentation from Coleman Peak erupting and spewing its bowels into the upper Chewuch or from an earthquake collapsing North Twenty Mile Mountain and plugging the upper Chewuch valley and impounding water to British Columbia. The "catastrophic" habitat is not met with corresponding catastrophic fish abundance. The standing crop of fish at RM 7.8, 14.7, 17.4, and 23.3 was 2.7, 0.6, 0.2, and 1.2 g/m^2 respectively in the late 1980s (Mullan et al. 1992). Notice that the highest abundance occurred in the austere flow just below the Chewuch Canal Company's irrigation diversion. Though these numbers don't receive the highest comparative fish density marks within the Methow basin, they defy the term catastrophe.

It's true that LWD was removed in the Chewuch and Twisp Rivers following the 1972 flood to reduce damage to bridges during future flooding. How much of this material was in the water and contributed to fish production and how much was found in the floodplain above the water is speculation. Comparing abundance of LWD in roadless areas above accessible reaches where removal might have occurred is one reasonable clue to the possible impact. Such a comparison would also address the assertion that the largest trees have been removed lowering the amount of LWD large enough lodge in the stream channel without being scoured out during flooding. LWD in the Lost, West Fork Methow, Chewuch, and Twisp Rivers above road ends is surprisingly sparse in these narrow, high energy channels, which is an indication that LWD loading is not comparable here with densely forested, lowland, coastal rivers. Further, the authors' failure to recognize the importance of rocks exacerbates the illusion of doomsday.

Channelization of the creeks mentioned is of no discernable lasting biological consequence, and I'm not sure such has occurred at Lake and Boulder Creeks.

Beaver trapping started in earnest with the establishment of Fort Okanogan in 1811, many decades before settlement. The Robinson brothers complained that the upper Methow was trapped out in the late 1880s. For a time (1920s) trapping was prohibited and beaver recovered to the point that their numbers required control (Portman 1993). But now the limiting factor for beaver is food in the form of riparian deciduous vegetation and their abundance ebbs and flows accordingly. Mullan et al. (1992) showed that changed forest practices over the past century have reduced fire and changed vegetative cover from open stands of fire-tolerant species to dense thickets of less fire-tolerant species from the uplands to the streambanks. They also present photographs that illustrate the recovery of riparian vegetation from the 500-year 1948 flood. I observed profuse beaver cuttings in 1987 in aggraded reaches, where luxuriant riparian vegetation is concentrated. George Brady, WDFW wildlife agent and trapper, relates that Methow beaver numbers have oscillated in his tenure (1971-2000) from lows in the 1970s, peaking in the 1980s, and declining again consistent with the species' natural wax and wane tendency. This trend does not imply that riparian vegetation is declining by human abuse (except for overgrazing in some mountain meadows and riparian areas) or over-trapping, as the authors cavalierly contend.

As detailed above, of the four standing crop estimates of fish in the Chewuch mainstem the highest estimate occurred immediately below the Chewuch Canal Company's diversion where the river's cross-section was filled with protruding boulders, a result of both diversion and severe drought. IFIM theory would undoubtedly predict devastation, assuming that an incremental drop in flow would induce an incremental reduction in fish.
But the fish persisted, presumably until the diversion ceased in early October. Mullan et al. (1992) also noted that the 10 mile section of the upper Methow that dried in 1987 supported large numbers of juvenile spring chinook, steelhead, and bull trout that remained put until declining flows dried at multiple points, first stranding the fish and then dooming all when the entire reach dewatered. Given adequate cover, e.g., boulders, the natural response to severe low flow is to stay put and persist. As I have stated repeatedly, the Methow Basin has demonstrated its ability to produce a healthy steelhead run with irrigation diversion rates higher than current rates.

Middle River Subwatershed

The authors again find little impropriety in leaping from qualitative insight to quantitative inference. They constantly confuse human activity with human impact because somewhere in the literature there is a study that supports their assertion. Is diking always damaging, and, if so, what is the specific damage? Just how much LWD was removed and how much of it was actually used by fish, i.e., located in the water, not stranded above the ordinary high water mark? Couldn't the benefits of riprap associated with the dikes counter or even exceed the potential loss of LWD and increase habitat complexity? Just how much riparian areas have been converted to residences and farms? What percentage of viable side-channels (both of number and area) has been disconnected? I know of one. The report by Gower and Espie (1999) is more establishment gray literature because it was never ground truthed or peer reviewed. The findings were so obviously erroneous that Joe Foster, regional fish biologist for WDFW, and I investigated some of the alleged unscreened ditches and blockages in the headwater regions and found no semblance of truth.

Lower Methow River Subwatershed

The statement that there has been no habitat surveys for this section of the Methow River is false. Mullan et al. (1992) had much to say about the habitat conditions there. They also present fish abundance estimates.

Libby Creek has no evidence of historical use by spring chinook or bull trout. The lower 1.0 mile of this creek is used heavily by steelhead for spawning and initial rearing. Ground water discharge is the attraction for steelhead. Luxuriant riparian vegetation supports long term beaver colonies whose dams have limited upstream passage of spawners since at least 1987, though it's unclear whether spawners actually are intent on moving above the preferred groundwater discharge area. Lower Libby Creek does not dewater even under the most severe drought.

The riprap along lower Gold Creek is a plus, not a minus. Dewatering in Gold Creek occurs in a losing reach between 2 and 3 miles above the mouth. This does not block passage of spring chinook, which enter and pass during high water. For example, in 1987 Mullan et al. (1992) found a chinook redd at RM4.3, a year of extreme drought. Standing crop estimates the Gold Creek mainstem (RM 4.3), South Fork (RM 3.8 and 5.9), Foggy Dew (RM 3.4), and Crater Creek (1.9) are consistently high compared to other creeks.

Inventory and Assessment of Data Gaps for the Watershed

My only comment is that the listed data gaps are the types of answers that I hoped this report would provide.

INTRODUCTION (4 pages)

Paragraph 3, p 1 of 4

Why isn't westslope cutthroat considered? The Fish and Wildlife Service is currently considering them for listing (threatened).

Paragraph 3, p 1 of 4

The independent determination of limiting factors by each scientific entity is a limiting factor itself. Each entity can be expected to make a strong case that conditions are limiting in their respective discipline. Who will ultimately oversee this imposing collection of limiting factors and sift the wheat from the chafe? The answer is—nobody—and all disciplines are free to bring their "dog" to the fight.

Paragraph 4, p 1 of 4

Who are the individuals of TAG? Who is the author (s)? We are asked to believe in their technical expertise but we have no idea who they are and what their experience might be.

Paragraph 2, p 2 of 4

There are powerful biological factors that shape salmonid characteristics. See Mullan et al. (1992, Appendix K).

Para. 4, p 2 of 4

The authors need to remember that salmonids need <u>cool</u> water not cold water. This report fails to do justice to the fact that <u>cold</u> water can be just as inhibiting as warm water. Water flowing at a natural rate may mean dewatering, since many reaches naturally dewater.

Salmonids benefit from vegetative cover, but this is not absolutely needed. The healthy bull trout population in the Lost River does just fine in reaches that have no vegetative cover. Steelhead require no vegetative cover, doing well in the rocks. Salmon, especially coho, have a much greater need of vegetation.

Para. 1, p 3 of 4

The logic of delays being critical for anadromous species in the Methow is unfounded unless one can demonstrate supporting empirical evidence. The idea is devastating, but the claim is doomsday dressing. Spring chinook and steelhead move to spawning sites when flows are high and cool. The delays or outright mortality resulting from encountering 9 mainstem days is the issue.

Para 1, p 4 of 4
The paragraph is too idealistic. Plenty of the streams in the Methow are healthy and naturally exhibit little or no floodplain, riparian vegetation, or sinuosity.

WATHERSHED OVERVIEW (6 pages)

Para. 2, p 2 of 6
If Andrews Creek runoff starts later than the lower Methow mainstem as the authors reveal, then why isn't it logical to expect that summer low flow timing would differ also? To attribute low timing difference between the lower mainstem and headwater streams requires knowing what the flow pattern was for the mainstems before irrigation. That Vern LaMotte's father walked across the Methow River at Silver on October 8, 1908 before irrigation dismisses the authors' contention that irrigation has changed runoff patterns.

HABITAT LIMITING FACTORS BY SUBWATERSHED

Para. 1, p 1 of 92
The authors should say that this chapter identifies the POSSIBLE habitat factors limiting…. since they are using their judgement and the literature rather than the smoking gun of cadavers in hand.

Para. 1, p 2 of 92
What the authors have seen or studied represent known and documented locations of <u>habitat</u> impacts not <u>fish</u> impacts.

Para. 4, p 2 of 92
This paragraph is too idealistic. Riparian vegetation may be ideal but it's not essential. How could salmonids colonize a rockbound Methow subsequent to the glacier's last retreat? How do salmonids survive in alpine lakes and streams above tree line? How do steelhead survive the lower Methow where there is little riparian vegetation or LWD? I don't mind these utopian models of habitat as long as the limitations are recognized and application is rightheaded. But the idea that all reaches in all streams must meet all standards to be healthy is ludicrous.

If the water is too cold or warm fish can't compete well with other species, gather food, or escape predators. The whole idea of species interactions and the role temperature plays in this is missing. The authors should read Appendix k in Mullan et al. (1992).

Shading of the largest Ponderosa Pines will not materially aid in cooling the Methow mainstem because the shadows are not long enough and fall the wrong way for a river aligned north-south. There is little riparian vegetation along much of the Lost River and lower Methow yet there is no sedimentation problem from eroding banks because natural riprap or rock armors the bank.

Para. 5, p 2 of 92
Bull trout don't spawn in larger streams and rivers with chinook salmon; they absolutely must spawn above them in headwater streams where low temperatures favor and isolate them.

Page 3 of 92
Culverts: This section overstates reality. Culverts can be all that the authors claim but not all culverts are guilty. Many who pass judgement on culverts have no idea what constitutes a blockage or the capacity of fish, and the authors shed no light on the subject. The culvert in Reynolds Creek is not a barrier to adult bull trout and steelhead parr. Marked residual smolts stocked below the culvert were found above it. Fry might not be able to pass this culvert but the exclusivity of bull trout in this reach suggest that "pull in" rearing did not occur this far upstream, which agrees with my experience that such rearing is confined to a very short distance (< 100m) above the mainstem. The same can be said of the lowest culvert on Little Bridge Creek. We found marked hatchery steelhead and wild spring chinook above this culvert that has been identified as obstructing juvenile salmonids. The lower highway culvert on Beaver Creek routinely passes adult steelhead and it is doubtful that "pull in" rearing for juveniles ascended beyond that point, especially in the past century as the creek above the culvert dewaters in the summer.

Page 3 of 92
Dikes, dams, etc.: Again, the worst-case scenario is emphasized and possible benefits overlooked. The most unproductive portions of the Methow mainstem (e.g., the reach between Twisp and Carlton) are the aggraded zones (austere gravel bottoms with few boulders) where the river flows through widened floodplains slowly and sometimes in braided channels as runs or glides with few pools or any semblance of cover for juveniles or adults. This is precisely the zone where LWD accumulations are possible and needed to form pools and provide cover. The authors and others speculate that it was removed by the Corps of Engineers after the 1972 flood. Methow Valley native, Ken White, however, noted that before the 1948 flood gigantic logjams 30 feet deep and half a mile long had over time built up in certain places on the river and that the flood picked up and removed the logjams like a pile of sticks (Portman 1993). The force and affects of this 500 year flood should not be understated. In addition to purging LWD the flood blew out all of the bridges, multiple sections of many roads, portions of some orchards, and reconfigured both streambanks and channels in many areas. Soft-bank reaches eroded and riparian vegetation, including 200 year old trees, were uprooted and washed away (Portman 1993). Methow natives Ken White (Portman 1993) and Jerry Sullivan (pers. comm. 2000) observed that the post-flood channel in the Twisp-Winthrop area was wider and shallower, and pre-flood pools, logs, and willows were greatly reduced. Ken White reported that this characterization of the river had not changed following the 1972 flood and lamented

that new pools might have formed had not the Army Corps of Engineers burned all of the uprooted trees hung up on the newly formed gravel bars.

This historical perspective suggests that LWD abundance is dynamic, abruptly lost during the most severe floods (1894, 1948, and 1972) and accumulating slowly between major floods. The salvage work following the 1972 flood removed mostly LWD stranded high and dry in the floodplain and unavailable for fish. The Corps' effort is guilty of obstructing the recovery process of LWD, but its affect on fish has been grossly overstated because most of the functional LWD had not yet recovered from the holocaust of the 1948 flood, contrary to the simplistic deductions of the authors and others. A comparable situation may be found in the upper Methow today where LWD has amassed on the floodplains but not in the water at low flow. LWD recruitment is confined to the aggrading reaches. Accordingly, removal of LWD below Carlton was unnecessary because it did not buildup there.

Another mistaken assumption is that LWD is equally valuable to all species. Each species occupies different niches within the stream channel. Steelhead prefer boulder-riffle habitat and are less dependent on LWD and pools than salmon and bull trout, which may explain why steelhead recruitment rates did not appear to crash from the loss of pools and LWD following the 1948 flood (Mullan et al. 1992. Indeed, steelhead may have benefited, both from habitat alteration and reduced abundance of competitive salmon, which probably were disproportionately affected by the changed environment. Recruitment rates for salmon during this period are not available. Answers to the questions of how much useful LWD was removed, especially in the Twisp and Chewuch Rivers where documented is skimpy and the natural recruitment dynamics of LWD in various reaches are paramount and need careful study.

I'm not an advocate for dikes, but apart from textbook idealism and at the risk of blasphemy, I observe few problems and some benefits with the dikes in question. The benefits come from the riprap armor, which provides excellent habitat where the main current flows directly into or parallel to this material for juveniles and adults alike. Channel confinement undoubtedly has resulted in the need for bank protection (riprap) downstream in some instances. But this has further increased habitat quality and quantity. The riprap protecting the dike located at the Winthrop National Hatchery has so stabilized the bank that now cottonwood trees and other riparian vegetation are immerging from the rock (Mullan et al. 1992, page 138). The greening of riprap in the Okanogan River is accelerated by sedimentation of the rock during highwater. The riparian vegetation so camouflages the rock that riprap opponents can't tell that the bank has been riprapped. Given time the same will occur in the Methow.

Scouring in vast reaches dominated by gravel is more asset than liability, because scouring exposes larger rocks, which yields better, more complex habitat. I won't argue that dikes can reduce LWD recruitment but given the rather insignificant extent of dikes and the compensatory habitat gain from riprap armoring I don't find the problem compelling. Considering the narrow valley and the porosity of the substrate, flow need not inundate the floodplain to recharge adjacent aquifers. The one destructive aspect of dikes that I can point to is the blocking off of side-channels that retain water year around, offering critical overwinter habitat for spring chinook, coho, and whitefish. But many blocked side channels or floodplains, however, do not remain wet and may actually strand fish. I can think of only one viable side channel rendered totally dysfunctional by a dike. I elaborate later.

Irrigation Diversions and Screens (p 3 of 92)
I won't rehash what I've already discussed except to emphasize that the issues are far more technically sophisticated than generally perceive. A fish behind a screen represents a loss only if that fish were not doomed to die in the river, and there are powerful, natural reasons why a saved fish is an illusion of the innocent. This explains why steelhead and salmon runs sustained themselves for the first 40 years of this century even when the ditches had <u>no</u> screens and the runs were grossly overfished and otherwise abused.

Is there one documented case where temporary berms that irrigators have pushed up to divert water into headgates during low flow has blocked fish? Early in my career I checked out several of these without finding much concern for worry. Berms in the Chewuch pose some risk as some spring chinook spawners hold in the Methow until moving upstream just before spawning, presumably to avoid the warmer water in the Chewuch.

Floodplains (p 4 of 92)
The ensuing discussion is a presentation of a generalized, idealized model without reconciliation to local uniqueness or limitation. Floodplains are limited and there has been a general recovery trend of riparian habitat since the 1948 year flood (Mullan et al. 1992). Alluvial fans are generally unproductive to fish because of flow and channel instability. I suspect that many streams flowing across their alluvial fan naturally dewatered in the winter. Channelizing the alluvial fans facilitate passage and rearing. The groundwater discharge associated with alluvial fans is important, but this function is not significantly dependent on annual inundation because high transmissivity minimizes water storage and maximizes lateral movement of water from a confined channel.

Bank Hardening (p 5 of 92)
Mullan et al. (1992), who enumerated salmonids throughout the Methow basin, came to understand the importance of riprap (pp. 137-38). I dispute every point that the authors make about the alleged negatives of riprap. Riprap provides critical habitat in the Methow basin and it has help counter other abuses by man. I'm not saying that it's a panacea or that some riprap applications are inappropriate, but good decisions and guidance is not brain surgery and agency technicians can do the job. But first the agencies must put aside their manuals and recognize the value of riprap.

Draining Floodplain Wetlands (p 5 of 92)
I'm not aware of such abuse, but I have not studied this issue. I suspect that this discourse is mostly theory and an unbalanced excursion through the dark side of the issue. For example, wetland generation via leaky irrigation ditches has been missed.

Riparian (p 5 of 92)
The authors take the reader on another ride through textbook theory extolling the bridge between the riparian and the aquatic but the bridge between the textbook and Methow riparian uniqueness was not built, leaving me with yet more platitudes, distortions, and questions.

Timber Harvest or Clearing (p 6 of 92)
The authors are right on this topic. The riparian zone should be off limits to timber harvesting activities and some past abuses of this kind are evident.

Livestock Grazing (p 7 of 92)
I agree. Long-term grazing has degraded habitat, especially in 3rd order streams or smaller including mountain meadows. George Brady opines that grazing probably has reduced beaver abundance in upland streams but not in the valley bottoms.

Large Woody Debris (p 7 of 92)
The first paragraph under this subsection trivializes a very complex, controversial subject. The potential for LWD recruitment varies substantially between the flat, wide, soft-bottom aggrading sections and the precipitous, narrow, hard-bottom, degrading reaches. The Lost River in the Pasayten Wilderness illustrates the point—LWD is mostly limited to a large logjam in the flat perched above the canyon between Diamond and Drake Creeks, where the river dashes and roars through barren rocks. LWD is critical in the former reach and rocks are critical in the latter.

Absence of LWD (p 8 of 92)
This section continues with the platitudes, bias, and over-emphasis of LWD. None of the points mentioned apply to the high energy, confined, hard-bottomed sections that are common in the Methow basin.

Channel Conditions and Streambed Sediments (p 8 of 92)
Unfortunately, the theoretical possibilities are presented to the exclusion of local information. For example, Mullan et al. (1992) examined the sedimentation issue and reported that human activities have caused sedimentation to rise 10% above natural background levels based on US Forest Service (USFS) documentation. They acknowledged that this was an average and that sedimentation will vary with the extent of disturbances in a given watershed. They found few aggrading channels in conducting standing crop estimates of fish in a wide array of reaches within and among a host of streams in the Methow basin. Their conclusion was that the high-energy streams of the Methow basin have high flushing rates, which help mitigate sediment buildup. Subsequent to their work the USFS has evaluated sedimentation in many subwatersheds. The authors of this report have reported this new information, but they have not attempted to correlate it with fish abundance (e.g., standing crop estimates reported in Mullan et al. 1992). This silence leads the reader to the edge of the cliff for the deductive leap that sedimentation is devastating.

Water Quantity and Water Quality (p 9 of 92)

This discussion continues building the case that the habitat in every aspect is debilitated and the proof is found in the ESA listings. I've noticed that previous assessments of habitat limiting factors set out to explain how habitat alterations have contributed to ESA listing, but when the road gets bumpy ESA listing is used to show that habitat factors are limiting. Maybe the authors are correct but they can't show cause and effect with these simplistic, incomplete, bias treatments of complex issues. Every possible horror is listed without showing that such horrors are actually occurring or relating them to the unique, mitigating characteristics of the Methow. They avoid using local science in favor of generic science. Perhaps they find Mullan et al. (1992) unworthy or perhaps they wish to avoid dissenting views. Whatever the case, we simply can't objectively determine whether habitat is limiting or not.

Show one example where low flows have delayed migration. If low flow increases anchor ice formation, then what chance do fish have when seasonal low flow coincides with seasonal thermal lows? And does this mean that the smallest streams are less viable for producing salmonids because their water mass is smaller and more susceptible to anchor ice?

Paragraph 3, p 10 of 92

If 73-77^{o} F is lethal to salmonids, then someone should write an obituary for the Okanogan sockeye salmon run. Where are the limiting factors regarding water temperatures that are too cold?

Para. 4, p 10 of 92

The listing should include determining the outcome of species interactions and the distribution of species within basins (Mullan et al. 1992, appendix k).

Para. 5, p 10 of 92

Nitrate and phosphate contributions by humans are increasing productivity in the Methow (Mullan et al. 1992)

Water Diversions (p 10 of 92)

The list should include:

1. cool temperatures by groundwater recharge
2. reduce severity of spring flooding by diverting flow
3. increase chemical productivity by groundwater recharge
4. maintain available rearing areas for juveniles by delayed recharge.

Biological Processes (p 11 and 12 of 92)

The beat goes on. It is assumed that beaver have declined in the Methow without documentation. The general again takes precedent over the local. The virtue of beaver is lauded and the vice is ignored. The positives of population control are ignored.

The authors state that the <u>impacts</u> of releasing domesticated fish into the Methow is pervasive. What impacts? This is another careless, leading deduction. They should have said that the <u>release</u> of hatchery fish is pervasive.

Mullan et al. (1992) is cited to support the doomsday contention that brook trout are apt to extirpate bull trout, but they refrain from citing the mitigating factors.

Similarly, Mullan et al. (1992) is cited to show that the Methow is naturally nutrient deficient to link the reduced number of spawners to a loss of productivity, but they neglect to mention that those authors provide information that humans have increased these same nutrients.

Loss of Beaver Activity (p 12 of 92):
The list should include:
1. increase sedimentation
2. decrease habitat for steelhead juveniles
3. obstruct passage of spawners and juveniles
4. increase water temperatures
5. decrease recruitment of large woody debris
6. decrease riparian functions by denuding vegetation when populations are excessive.

Brook Trout Introductions (p 12 of 92):
Brook trout don't compete with bull trout; they eliminate them.

Decrease in Salmon Carcasses (p 13 of 92):
I don't discount that nutrient enrichment via carcass decay might boost productivity to some degree, but remember that there was a healthy steelhead population long after the chinooks and coho declined and that juvenile steelhead production today approaches MSY. Steelhead spawners don't contribute to nutrient cycling (within the Methow itself) because they move out of the watershed once spawning is complete. Further, Indians harvested salmon and they routinely collected carcasses. There were years when the runs failed (Mullan et al. 1992). Nutrient enrichment was limited to the mainstems of the larger tributaries and the Methow itself where the chinooks and coho spawned. Man is now introducing nutrients into the watershed.

Data Gaps (p 13 of 92):
Whoa! Habitat issues do not operate independently from the whole. There are other pieces to the puzzle that must be fitted together with habitat. I suspect that with the completion of each limiting factors report for each scientific discipline the authors will conclude, as the authors of this report have, that the reason for ESA listing can be found within their respective bailiwicks. This situation exists because the power of organizational bias swamps scientific ethic. They have offered up every negative possibility so that the pile of "proofs" is so high that an agenda friendly outcome is as immutable as the law of gravity. I have previously exposed some of the bias; I continue with the discussion found in paragraph 3 of page 15 where the authors attempt to show that the Methow Valley Irrigation District's (MVID) leaky ditches contribute

insignificant recharge to the Methow. Ironically, Mullan et al. (1992), whose monograph of 489 pages offered a contrary view, was silenced without mention, victimized by BPA's very simplistic model!

Even had the authors shown that habitat alterations are legitimate they must demonstrate with clarity cause (habitat changes)-and-effect (changes in fish productivity), and they have not done so. Until they do, I believe that some of the data gap proposals are extravagant and exercises in re-inventing the wheel. For example, the first proposal is so daunting that study is eternal. The authors seem to view habitat affects as fish affects, naively indifferent to the monumental difference. A productive place to develop data gap study would be within the swirl of controversy enveloping Mullan et al. (1992) who blazed the trail in attempting to define an ecosystem view of factors limiting mid-Columbia salmonids. As noted above WDFW contracted the American Fisheries Society to rigorously review Monograph 1. Apart from obvious bias inherent in establishment reviewers critiquing an anti-establishment report, the TAG would be well served in examining the points of contention in those reviews. To their credit the authors have identified the primary sticking point—whether irrigation withdrawal is limiting or not. The second major area of controversy centers on the historical distribution and role of LWD. But even the urgency of this diminishes if we change riparian practices that maximizes and accelerates LWD generation and recruitment. Substantial changes have already taken place and LWD is accumulating in the aggrading sections of the upper Methow, Twisp and Chewuch Rivers.

As for the other data gap proposals of study, I recommend action rather than study. I agree with Jack Ward Thomas' (2000) assertion, "that more and more and more assessment does not produce significantly different results" and "declines in fish runs may well continue as the inverse of expenditures, with no indication of cause-and-effect". The most dramatic change for habitat protection and improvement in the past decade has been the USFS' new commitment to habitat as manifest by staffing its districts with biologist who are systematically evaluating habitat conditions, recommending remedial actions, and taking action. Jeanette Smith of the Pacific Watershed Institute has added to our knowledge, particularly concerning the role of LWD. The catalogue of habitat issues presented in this report identify the problems (and many non-problems), and we know what must be done—protect the habitat and the processes that shape habitat. What is it that we don't know that will materially change restoration outcomes? We should not miss the benevolent changes that are currently underway and directed at getting out and staying out of the riparian corridors—chainsaws, livestock, and roads. This done, the Methow will heal its own blemishes without further ado in the same manner that the Mount St. Helens streams recovered to equal or exceed coho production in unaffected streams in three to six years (Bisson et al. 1988

Upper Methow River Watershed (p 16 of 92)
The upper Methow River above Robinson Creek is called the West Fork Methow R.

Table 1. (p 17 of 92)

The West Fork Methow R. should have its own line and all 3 categories should be listed for spring chinook, steelhead, and bull trout.

Access to Spawning and Rearing Habitat (p 18 of 92)
Low flows and dewatering do not create a passage barrier to adult or juveniles. Remember, these fish are the product of 10,000 years of evolution, which programs them to pass the reach in question when flows are adequate.

Lost River Dike (p 18 of 92)
What about the rearing increase afforded by the riprap? The side channel is not viable and does not contain water every year even during high water. Stranding is likely to occur. The dike constrains flow insignificantly because the stream channel is so broad here.

McKinney Mountain Dike (p 18 of 92)
I visited this dike September 4, 2000 and found that the dike actually blocks the upstream ends of two side channels—one at elevated flows and one at low flows. Both channels contained water, fish, and beaver. Fish are gaining access at the downstream ends of the channels, probably in high water to pass the beaver dams. Though the higher channel is elevated above the river in low flow, the water table remains high and the channel fills with water that seeps under the dike, which sets high and dry. The river engages the dike downstream where it blocks the second channel. Here water seeps through and under the dike and flowing water and fish are apparent immediately below the dike. The dike is providing excellent fish habitat where the flows sweep into it, but considering the scarcity side-channel habitat and assuming that productivity is being impaired tradeoff benefits may not be a bargain. The dike does deflect the water away from the channels and the floodplain towards the East Mazama highway. Aside from serving as a roadbed for a recreational trail, the function of this dike is not apparent to me. It appears to be a good candidate for breaching.

Dike (RM 55.5) (p 18 of 92)
There is no dike at this location.

USFWS Hatchery Dike (p 19 of 92)
Mullan et al. (1992) enumerated salmonids along this dike and found it loaded with steelhead, chinooks, bull trout, and mountain whitefish. Even riparian vegetation is developing along this dike.

(p. 19 of 92)
Various streambank sections that have been riprapped are detailed. Riprap stabilize streambanks and provide optimum habitat in the interstitial space between rocks. Constraining river channels is not an inevitable result of riprap application. The riprap above Wolf Creek hardly disturbed riparian vegetation and is mostly above the water. These riprap reaches are providing key rearing habitat for salmon and steelhead.

LWD (p 20 of 92)
The bars are full of LWD, the problem is that little of it is found in the water. I'm not convinced of the propriety of LWD recruitment in the Methow Lost River above Weeman Bridge since attracting juveniles there will doom then when flows dewater, a phenomenon that I've witnessed.

There may be large trees in the Lost River basin but that doesn't mean recruitment will be good. Except for some logjams in an aggrading reach at the head of the canyon below Diamond Creek, there is very little LWD in this basin, a basin that is essentially pristine.

Para. 1-3, p 21 of 92
Isn't this discussion about pool/riffle ratios rather academic since the reach is so unproductive based on low flows and dewatering? More and deeper pools likely would increase stranding.

Water Quantity and Water Quality (p 21of 92)
I consider the thermal conditions in this reach of the Methow (RM 50.4) to be the best for steelhead in the entire basin (Mullan et al. 1992, pages 109 and 111 and appendix k). Are (303) d standards attuned to what's best for fish? Since different species have different thermal requirements how does one size fit all?

Biological Processes (p 22 of 92)
Brook trout are rare in the anadromous zones because warm water temperatures put them at competitive disadvantage (Mullan et al. 1992). They sampled 25 sites in the mainstem and tributaries and found only one brook trout (mainstem at RM 50.4). Brook trout reproduce only in cold springs (e.g., Hancock Creek and riparian springs such as those found on the Heath Ranch), where they are likely to displace listed species there.

What beaver decline? No supportive data is presented. In the early 1990s I observed much beaver activity between Weeman Bridge and Winthrop. Profuse beaver sign was noted on September 3, 2000 in the channels behind the McKinney Dike. Above Weeman Bridge beaver respond to the lack of water like the fish do—they avoid it.

The status of the irrigation ditch on WDFW land (Big Valley Ranch) which may be instrumental in maintaining adjacent wetlands is not mentioned.

Last para., p 24 of 1992
What's the mystery? Porous alluvial deposits plus low flows equals natural dewatering and poor fish production. Not all is lost, for the groundwater discharge from the Goat Creek alluvial fans offers prime spawning and rearing for spring chinooks.

Para. 2, p 25 of 92
Go ahead and remove the culvert, but it's rather academic since there is no anadromy or bull trout in Whiteface Creek.

Riparian (p 25 of 92)
There is heavy grazing in upper Goat Creek where the bull trout are located. This stock is very tenuous and temperature sensitive. It deserves extraordinary measures of protection such as a logging prohibition and perhaps fencing.

Para. 2, p 27 of 92
Summer peak temperature of 65°F in the resident steelhead zone is not threatening or as risky as the reported 54°F for bull trout in the upper watershed because resident steelhead prefer warmer temperature than bull trout. Only Goat and Beaver Creeks have high enough relief to sustain water temperatures cool enough for bull trout in subwatersheds on the east flank of the Methow basin. Temperature is inversely correlated to elevation, and even heavily shaded streams are too warm except at the highest elevation.

Peak temperature is not the only measure of thermal suitability. The temperature of Goat Creek the rest of the year is too cold—mostly in the 30s and 40s.

Biological Processes (p 29 of 92)
I agree that the decline of beaver in Goat Creek might be related to overgrazing. Once overgrazed, vegetation may never recover without fencing.

LWD (p 30 of 92)
At RM 1.4 of Wolf Creek in the anadromous zone the population density of juvenile steelhead was excellent (6.9 g/m^2) compared to other estimates collected throughout mid-Columbia streams. This shows that fish production can be outstanding without LWD in the boulder/riffle habitat. How can recruitment of LWD be good above RM1.5 but poor below? I thought LWD is mobile.

Channel Conditions and Streambed Sediment
There is no sediment problem in lower Wolf Creek as fish abundance testify.

Is pool formation only possible via LWD? Have the authors heard of pocket pools or plunge pools?

Water Quantity and Quality (p 30-31 of 92)
The only low flows on Wolf Creek is on the alluvial fan, which is a natural feature throughout the Methow basin. The creek has dewatered in the alluvial fan in the winter months after the cessation of irrigation. The 303 (d) listing is meaningless as an indicator of fish production in Wolf Creek, arguably the best producer of fish in Methow basin.

Be consistent. Temperatures above 60°F are just as limiting here as they are in Goat Creek and elsewhere. But peak temperature at the mouth does not reflect conditions upstream and peak temperature for a few days in August is not near as limiting as the cold temperatures the rest of the year.

Data Gap (p 31 of 92)
The answer for thermal characteristics of Wolf Creek for any given elevation is given on page 328 of Mullan et al. (1992). Temperatures cool with increasing elevation, and to judge a stream based on peak temperatures at its mouth is improper. Wolf Creek supports the highest density of salmonids in the Methow basin.

Little Boulder Creek (p 32 of 92)
The drop between culvert and water surface at low flow is 4 feet, which does not block adult steelhead. The culvert is fitted with baffles, which aid fish passage. The dispersion of flow and dewatering are natural characteristics of a stream flowing across its alluvial fan. This condition would be worse if the channel were not confined. During spring runoff streambed material is deposited at its alluvial fan at a time when high flows elevate the Methow and saturate the alluvial deposits. When Methow flows drop, the alluvial fan becomes perched above the Methow and gravity drains the porous material quickly, causing diminishing creek flows to eventually disappear into the loose substrate before reaching the river. This condition, however, does not mean that passage is a limiting factor for lower Little Boulder Creek, because during the spring and early summer at the time when much movement of juveniles is occurring to establish territories, fish have ready access to this creek. The large pool formed by the culvert discharge, which provides optimum habitat is not mentioned.

Hancock Creek originates from a spring in the valley floor and it lacks the widely ranging flows that mark creeks draining larger, higher areas. Therefore, when do high flows block passage through the culvert? If the creek is highly embedded from cattle grazing, lacking in pools, and full of brook trout as claimed on page 33, then how can Hancock Creek provide excellent year around habitat for rearing juveniles

Lost River Subwatershed (p 34 of 92)
There is not much LWD in the Lost River basin.

Access to Spawning and Rearing Habitat
There is a natural falls at RM 9.6 (between Monument and Drake Creeks), but anadromous production effectively ends at Monument Creek, the point at which the river does not dewater.

Para. 1, p 35 of 92
There is no passage problem in the lower Lost River and there are no viable rearing areas lost in the floodplain, as the one channel blocked by the dike seldom contains water even on high runoff years.

The river channel is broad at the mouth and the dike has little restraining affect.

LWD (p 35 of 92)
There are few riparian trees for miles in the Lost River Canyon.

Channel Conditions and Streambed Sediment (p 35 of 92)
This is the natural character of the Lost River; it does not change above the people.

Access to Spawning and Rearing Habitat (p 37 of 92)
There is no passage problem at lower Early Winters Creek. In the drought year of 1986 Mullan et al. (1992) sampled the lower 100 meters and found 2.3 g/m^2 of juvenile steelhead and spring chinook, the same number that we found in a secluded reach above all water diversions at RM 5.0.

Floodplains (p 37 of 92)
The natural condition of multi-channels dispersing across the alluvial fan would increase the odds for reduced passage and rearing.

Water Quantity and Water Quality (p 39 of 92)
Bull trout are not migrating into Early Winter Creek during peak temperatures, and peak temperatures are not a thermal block. The authors themselves show that the reported temperature (56.4^{o}F) is less than the threshold temperature (59^{o}F). Further, the diel curve for temperatures in this creek is great, and early morning temperature drops into the 40s^{o}F, inviting any thermally reticent fish to migrate. If 54^{o}F in upper Goat Creek is very cold, as we have previously been advised, then how could 56.4^{o}F approach the thermal passage threshold? Early Winters Creek is one of the coldest systems in the Methow basin.

How many redds are scoured in lower Early Winters Creek? If all of the gravel has previously been scoured out of the reach why would a fish spawn there? Let's give the fish some credit. Has anyone ever observed a redd in this reach? I doubt it.

Bank hardening doesn't reduce refuge; it increases it for both juveniles and adults.

Biological Processes
I suspect that the snorkel surveys indicating brook trout were actually bull trout, which are very similar in appearance. The USFS found no brook trout, as the authors report, but they failed to report that Mullan et al. (1992) found no brook trout in their sampling at RM 0.0,1.5, and 5.0 in 1987.

Water Quantity and Water Quality (p 49 of 92)
Harsh winter conditions and icing occur disproportionately high in the Chewuch? These alluvial fans are so small and the material so course that there is no sustained storage advantage from multiple channels versus a single channel across an alluvial fan. Surface ice is a good thing because anchor ice cannot form under it. The best place to overwinter in the Methow is in a 3rd order tributary stream that forms an ice bridge early to receive an insulating mantle of snow.

Water temperatures actually moderate under this condition and predators are excluded from this dark but stable environment. The worst place to winter is in the larger mainstem reaches, which resist ice bridging and snow cover. Here, conditions can be cataclysmic—ebbing and flowing between ice lockup (including anchor ice) and minimum flow versus breakup and flooding with masses of ice chunks devastating the substrate as they grind their way downstream.

Biological Processes (p 49 of 92)
The planted brook trout stocked in the creeks cited, pose no threat because they occur above barrier falls which exclude listed species. They pose little threat downstream because they cannot successfully compete with the species favored in warmer temperatures.

Water Quantity and Quality (p 51 of 92)
See comments above (page 49).

Biological Processes (p 51 of 92)
See comments above (page 49). Brook trout have not extirpated bull trout in Twentymile Creek.

LWD (52 of 92)
This mostly is academic because much of the reach is above the falls where there are no listed species. The road does not affect recruitment because it winds above the steep canyon through which the lower creek passes. What documentation is available to show that LWD has been removed from this stream? Except for the road at the mouth there is little access from which to remove LWD.

Channel Conditions and Streambed Sediment (52 of 92)
Just what is the impact of sedimentation on fish? A check of Table 8 (Mullan et al. 1992) shows that a RM 5.8 and 9.6 fish density (g/m^2) was 5.7 and 8.2, respectively, comparatively high numbers for Methow basin streams containing non-anadromous trout.

Water Quantity and Water Quality (52 of 92)
What channel scour? The road does not constrain lower Boulder Creek except at its very mouth.

Biological Processes (52 of 92)
Brook trout have not eliminated bull trout in Boulder Creek. Though the authors don't quote Mullan et al. (1992), it's obvious that is their source of information. Mullan et al. erroneously stated that brook trout extirpated bull trout in Boulder Creek; they meant to say Beaver Creek.

Access to Spawning and Rearing Habitat (53 of 92)
In the late 1980s Mullan et al. (1992) reported an exclusive population of brook trout.

Recommendations (55 of 92)

Bull trout are not spawning in lower Lake Creek. They spawn in Lake Creek above Black Lake, miles upstream.

Access to Spawning and Rearing Habitat (57 of 92)
NMFS enjoined the MVID to cease withdrawing water based on finding 34 steelhead and 3 spring chinook age-0 juveniles. When these numbers are converted to adult returns, the numbers round off to 0.

Alder Creek is no steelhead or salmon stream. A check of the creek in the canyon above the Twisp-Carlton road shows the natural impassability of this creek. The creek enters its alluvial fan upon emerging from under the aforementioned roadway. The creek spreads out in this riparian jungle and is impassable to any fish wishing to pass the culvert. Channelization would correct the problem, but the issue is moot because this is not a salmon or steelhead stream. Moreover, if this stream is as dangerously polluted as believed why is there concern for improving passage?

Floodplains (57 of 92)
Methow River. River Mile 0.0 to 0.5 does not occur in Winthrop. The authors must be referring to the Chewuch.

There is no residential development in the Alder Creek floodplain. The single road into the floodplain has been abandoned. The floodplain is an impenetrable stand of riparian vegetation.

LWD (58 of 92)
The extent to which LWD was removed is unknown yet the authors assume that it was high from their comment that levels today remain low. The authors seem eager to jump to the opinion that man's activities have increased velocities so that LWD cannot deposit in this section of the Methow. The fact is very little of this reach has been hardened and diked. Is LWD disproportionately accumulating in the untainted sections? The authors once again avoid complex matters by conveniently defaulting to professional opinion.

The authors have made a case that riparian zones have been stripped of trees large enough to be retained in the mainstem Methow, yet now the claim is that increased velocity is the primary factor. No mention is made of the possibility of tradeoff benefits of riprap as optimum fish habitat and the scoured channels that would increase streambed roughness and habitat complexity from an otherwise gravel-monotonous reach.

Water Quantity and Quality (58 of 92)
I don't support pollution, but just how significant is the Alder Creek problem? This is a tiny tributary. Later the authors point out that Alder Creek has passage problems, which exclude anadromous species from the pollution except at the mouth. Research was cited to show that non-migratory rainbow trout had elevated heavy metals in their gills and liver. Resident brook trout upstream and closer to the old mine and likely high levels of pollution are persisting.

Anadromous salmonids would have a very short exposure to Alder Creek pollution, since this creek is connected to the Methow only during the short time when Methow flows are fairly high. The authors cry wolf.

I realize that this is a report on the limiting factors not benefiting factors, but not considering possible nutrient benefits from the sewage treatment plants really skews what may actually be occurring. The authors cite Mullan et al. (1992) that the Methow is nutrient limited yet they ignore their conclusion that human-caused increases of nutrients may increase fish production. The authors have cited DOE's 303 (d) listings when standards are violated. What does DOE have to say about sewage treatment discharges?

Biological Processes (59 of 92)
Brook trout are non-migratory. How could they persist in a stream (Alder Creek) that is heavily contaminated?

Access to Spawning and Rearing Habitat (60 of 92)
I examined the culverts at the lower and upper Bear Creek crossing plus the culvert over which the Barclay ditch passes on September 14, 2000. Adult steelhead, the only species seeking entry into this creek as an adult, would pass any of these purported barriers in a heartbeat. In my opinion juvenile chinooks and steelhead would pass these culverts with ease. The authors need to produce some evidence for their claim.

Apart from some juvenile rearing near the mouth does this stream have any potential for listed species?

Floodplains (60 of 92)
What floodplain function? I doubt if Bear Creek ever overtops its banks because of the creek's low elevation and western aspect, factors that reduce snowpack and cause early but slow runoff to minimize flooding.

Riparian (60 of 92)
Bear Creek has good riparian habitat for the most part.

Channel condition and streambed sediment (60 of 92)
Sedimentation is evident but it's unclear whether this is natural or man-caused. Grazing is occurring in spots but streambanks there are not in bad shape.

Water quantity and quality (60 of 92)
There is a bypass structure in the Barclay ditch crossing of Bear Creek. When I visited the site on September 14, 2000 the bypass was boarded closed precluding water from entering Bear Creek. Water temperature in the Barclay ditch was 60^{o}F at 1500 hr vs 59^{o}F for Bear Creek. I'm not sure what threat the ditch poses for Bear Creek.

Beaver Creek Drainage (60 and 61 of 92)
As I have already indicated the Gower and Espie report has serious problems. This report was not reviewed by local biologists. How many of the unscreened intakes were actually in the anadromous zone? Chinook likely never used Beaver Creek except for seasonal juvenile rearing at the mouth.

South Fork Beaver Creek (p64 of 92)
The problems purported here are academic because the stream is too cold for steelhead except near the mouth and occupied now by brook trout. Before the brook trout, bull trout dominated.

Middle Fork Creek (p64 of 92)
See comments just made for the South Fork.

Channel Conditions and Streambed Sediments (p64 of 92)
Mullan et al. (1992) noted the sedimentation in the Beaver Creek basin, but fish densities at all four points examined in the South and Middle Forks ranged from average to above average.

Biological Processes (p65 of 92)
There is still plenty of beaver in lower Beaver Creek, though abundance is cyclical. The potential for beaver to re-colonize headwater meadows may be reduced by long term overgrazing. Fence the sensitive meadows and the beaver will come back on their own.

Recommendations (p67 of 92)
Brook trout numbers need to be eliminated not reduced.

Table 3 (p68 of 92)
Bull trout spawn in the Twisp River; they do not spawn in South and War Creeks.

Floodplains (p68 and 69 of 92)
Are all wetlands isolated by roads and dikes? The peak weekly mean temperature at RM 0 is 59^{o}F and 56.3^{o}F at RM 11.1 (Mullan et al. 1992, p327). These are neither high temperatures nor do they represent undue warming over distance. Warming downstream can be explained by reduced elevation and distance from mountain snowfields. Though temperatures are colder in the Twisp than in the Chewuch (Mullan et al. 1992, p327), we have already been told that temperatures are okay in the Chewuch. Now the case is being made that the Twisp suffers form excessive temperatures. This appears to be an illegitimate attempt at impugning MVID's withdrawal, which is perceived as a problem.

The highly simplified channel claim for the river below Buttermilk Creek does not consider habitat enhancement from riprap.

The Twisp River Road does not constrain the Twisp River from the mouth to RM 9.0. It does so in spots, but not over the entire reach, as implied by careless wording.

Riparian (p69 of 92)
The purported loss of galleries of cottonwood trees is speculative. Lateral streambank storage of water is not considered. Rick Klinge, PUD biologist, told me that an entomologist from Montana who was hired to assess well sites for the new hatchery found riverine invertebrates 0.5 miles inland from the river's edge. The floodplain does not have to be flooded to produce vegetation. The old floodplain behind the City of Twisp dike abounds in cottonwood trees. Leaky irrigation ditches are not considered either.

LWD (p69 of 92)
Who says that LWD was removed from the entire Twisp River basin? Was LWD removed even from the inaccessible sites? How much LWD was actually removed? If the upper river has good LWD recruitment potential why wouldn't some of that be expected to reach the lower river. The reason that some LWD was removed in the past was because it was so mobile that it took out bridges and roads. Mullan et al. (1992) studied fish abundance (standing crop) of fish in the portion of the Twisp purportedly denuded of LWD (7 sites) versus standing crops of fish above the end of the road at 2 sites in the South Fork of Twisp River in pristine habitat and found no little difference (4.6 vs 5.3 g/m^2, respectively).

Has riprap played a mitigative role in any loss of LWD?

Channel Conditions and Streambank Sediment
The statement that sedimentation from Little Bridge, Poorman and Newby Creeks is degrading the lower 15 miles of the Twisp contradicts the ensuing statement that the lower Twisp lacks embeddedness. The same can be said of the numerous areas of erosion and mass-wasting banks, which fail to result in embeddedness. Amazingly, even clean gravel is an indicator of things gone wrong, i.e., the river has been so re-configured that it has been transformed from an aggrading to degrading stream! And this will manifest itself in lowering egg-to-fry survival. In reality this does not seem to happen judging by the 9 standing crop estimates (4 below RM 15 and 3 above) reported by Mullan et al. (1992).

Water Quantity and Water Quality (p70 and 71 of 92)
The conversion of 17.2^{o}C is 63.0^{o}F, not 69.9^{o}F. I have already shown that the peak weekly mean at RM 0 is 59^{o}F and that temperatures cool upstream. The water is so cold above North Creek that steelhead production stops there. The diel curve of water temperatures for the Twisp River is dramatic (personal experience from a thermograph placed under the bridge in the town of Twisp) so that if 64^{o}F is the daily high a 10^{o}F decline (54^{o}F) over the following 12 hours is expected on a cloudless night.

BPA's position that the MVID west canal is inefficient and in need of repair is debatable. It's true that for a distance immediately below the diversion point, flows limit salmonid production. But the Twisp recovers downstream from recharge from the leaky ditch and fish densities were greater at RM 1.2 and 0.0 than that measured at RM 15.6, though they were less than densities measured at other upriver sites. Mullan et al. (1992) measured habitat degraded by irrigation withdrawal at about 3% for the entire basin, a rather benign impact overall, especially if the net effect is less than 3% due to benefits accrued downstream from the diversion points.

NMFS personnel examined the west canal for entrainment of salmonid fish and none were reported in their injunction against MVID.

That the west canal diversion point actually blocks migratory fish is speculation. Spring chinook and bull trout pass upstream earlier when flows are greater and cooler.

Access to Spawning and Rearing Habitat (p73 and 74 of 92)
The listing of culvert barriers is dubious at best. What are the criteria for culvert passage? Mullan et al. (1992) found juvenile chinook and residual hatchery steelhead juveniles above the Little Bridge Creek at the mouth. I don't believe the culvert at RM 1.5 of East Fork of Buttermilk is a barrier to fish passage in low flow. What is migrating there at low flow? Adult fish pass obstacles far greater than this, and this culvert is well above spawning or rearing anadromous species.

LWD (p74 and 75 of 92)
Not much of the LWD was removed because most of this system is inaccessible. Removal was limited to a few road crossings and the alluvial fan area.

Channel Conditions and Streambed Sediment (p75 and 76 of 92)
The picture that is painted about high sedimentation and transport does not correlate to measured fish densities in the problem streams versus pristine streams. For example, fish abundance at 5 sites in the East and West Forks of Buttermilk Creek and 2 sites in Little Bridge Creek were greater than those found in War Creek (1 site), South Creek (1 site), and South Fork Twisp River (2 sites) which were in pristine condition where sampled (Mullan et al.1992).

Libby Creek Drainage (p79-80 of 92)
Mullan et al. (1992) found no bull trout in their survey.

Access to Spawning and Rearing Habitat (p79-80 of 92)
Lower Libby Creek does not dewater. I sampled the creek monthly throughout the year in the late 1980s under severe drought conditions at the Highway 20 bridge and found stable, bank to bank flows. On September 14, 2000 I found bank to bank flow (4 to 5 cfs) at the confluence with the Methow River. Home owner Gordy Welch, who has lived on the creek for 20 years including the grim drought years of the late 1980s, has never seen lower Libby Creek come close to dewatering.

Access to Spawning and Rearing Habitat (p80 of 92)
The culverts on the North Fork are not required to pass listed species, as only westslope cutthroat are found in this creek.

The creeks in Smith, Chicamun, and Ben Canyons are too small to be of consequence for anadromous steelhead, though they harbor resident steelhead in their lower portions.

The culvert at RM 2.5 on the South Fork is not required to pass any listed species, as only westslope cutthroat are found in that part of the creek.

Water Quantity and Quality (p83-84 of 92)
Why is the Pacfish standard for salmonid spawning applied to salmonid rearing? Temperatures are much lower when steelhead spawn in Libby Creek in April and May.

The last sentence of the first paragraph on page 84 is confusing. The authors have made a case that the riparian has been violated but now they describe Libby Creek as having "better shading" in their attempt to assuage what looks like excessive temperatures. The affect of temperature on fish has no bearing on the causes for the temperature, as implied. Elsewhere (Goat and Early Winters Creeks and the Twisp River) a big deal is made of temperatures that exceed 59^{o}F, but in Libby Creek the contradictory conclusion is that temperature is not an issue. I agree but for different reasons. The only listed species is steelhead and their temperature bounds are higher than bull trout or spring chinook. For most of the year cold water temperatures are a limiting factor for fish.

Biological Processes
Mullan et al. (1992) surveyed upper Libby Creek and the lower portions of the South and North Forks with electro-fishing gear and found 39.1% brook trout and 59.9% resident steelhead between RM 5.9-6.8 in Libby Creek. Only westslope cutthroat were found in the North Fork (RM 0.8-1.0). At RM 0.5 only resident steelhead were found in the South Fork, but upstream (RM 1.3) westslope cutthroat appeared as did cutthroat/rainbow hybrids, a sure sign that cutthroats would predominate upstream in colder water.

There is no evidence that bull trout used Libby Creek in recent history; it is naturally too small and warm.

There is heavy beaver activity in lower Libby Creek, and their dams are blocking migration of steelhead at the head of the alluvial fan above the highway crossing (from RM 1.2-1.5). In 1987 no spawners were observed above the dams up to RM 2.7. Passage is still impeded as of spring of 2000 (George Brady, WDFW, pers. comm.). Steelhead spawners are targeting groundwater discharge at the head of the alluvial fan for spawning, and it's unclear whether they would migrate further upstream if they could. Eleven redds and four adults were counted on one survey in May of 1987, making this a significant spawning and rearing stream. Judging by the small size of this stream and the concentration of spawners, a major portion of the fry are probably displaced via agnostic behavior during territorial confrontations to rear in the mainstem Methow. This dynamic setting of territories and downstream drift of fry occurs soon after emergence in June and July before any dewatering (Tredger, C.D. 1980).

Access to Spawning and Rearing Habitat (p 86 of 92)
I disagree that the culvert on the South Fork of Gold Creek at RM 3.6 is a barrier to fish passage, but this is academic because the population above and below the culvert are non-migratory steelhead.

LWD (p 87 of 92)
The correlation of low LWD and high sediments is not manifest in fish densities studied in the South Fork (2 sites), Foggy Dew Creek (1 site), Crater Creek (1 site), and Gold Creek (1 site) by Mullan et al.(1992), which were uniformly high compared to values found in pristine creeks elsewhere in the Methow basin.

Summary of Historic Events (p 1 of 17)
This discussion is a platitude that fails to capture the essence of the transformation of what was to what is and the factors that explain what happened. Many careless or unsubstantiated statements are made.

The authors cite the USFS for explaining the factors that determine the status of fish abundance today. What rigorous work has the USFS undertaken that merits such guru status? I doubt if the USFS has studied hydropower, hatchery domestication, harvest rates, estuary productivity, and ocean productivity. They have studied habitat conditions on their lands, but they have not published any reports that show that habitat condition and run status are correlated.

The raging debate between reputable scientists over whether habitat condition and function in the tributary streams significantly affects fish abundance was not even alluded to. Any serious scientific study today is compelled to recognize the divisive issues and seek to resolve them with good science.

What were the pre-settlement runs like, and how were the Indians who fished them distributed? What did the habitat look like in 1850 before settlers grazed livestock, suppressed fires, cut trees, built roads, diverted water, and trapped beaver? What affect did the floods of 1894, 1948, and 1972 have on the habitat? No pre-anglo historical insights are presented and the usual naive assumptions are inferred—the tributary streams drained the Garden of Eden and could not contain their writhing bounty.

Bull Trout (p4-5 of 17)
The three life history forms of bull trout were probably dispersed throughout the Methow….just as they are today, save the two watersheds where they have disappeared.
Temperature not only determines distribution and abundance it determines <u>life history</u> as well (Mullan et al. 1992, appendix k). What does gradient have to do with these?
Temperature is not critical at all life stages. Bull trout must be isolated from competitive species such as steelhead by spawning in water too cold for other species, which means they must get above other species in the very coldest water. The problem is that much optimum habitat is

isolated above impassable falls. Suitable cold water habitat is very limited in the Methow basin and insures that abundance of bull trout will remain limited, at least until the next ice age. Once bull trout reach parr size (2 or 3 years) cold temperature is no longer required and the parr can move downstream in much warmer water where they compete with other fish until they change trophic level to become predators. They are found in the warmest waters throughout their range including the Columbia River. The adults migrate all the way back to the headwaters not because they require cold water but rather because their progeny do. Spawning done, the kelts quickly head south (the mainstems or the Columbia) for the winter.

What's to know about the resident adults? What we don't know is where the migratory fish go and do.

Page 6
Don't put too much stock in the unknown status found in WDFW (1998a). I wrote that section of the report for the mid-Columbia streams and I felt confident in categorizing status for each stock. But WDFW discouraged this because they had no standardize criteria.

It's not necessary to say distinct stock; by definition stocks are distinct.

Bull trout have not gone extinct in Boulder Creek, at least since the last ice age, as stated in Mullan et al. (1992). We meant to say Beaver Creek.

South and Little Bridge Creeks do not contain reproducing populations of bull trout—only rearing "pull ins".

The notion that bull trout require absolutely pristine conditions is a coincidence from the bull trout's obligatory need for isolation via cold water. By spawning in the coldest water the bull trout unwittingly finds himself on the side of the mountain too steep for many of man's most egregious activities.

The bull trout's exacting spawning-initial rearing habitat is the linchpin for this species. These habitats are very limited and precarious and <u>maximum</u> <u>protection</u> is justified. Only small increase in temperature can result in the successful upstream invasion of steelhead. In fact, normal interglacial warming, apart from global warming or site specific warming from man's activities, may be enough to doom bull trout in the Methow in most streams. Fortunately, bull trout habitat is in good shape except for Blue Buck Creek and other creeks in the Beaver Creek basin where they are now extinct. The West Fork of Buttermilk Creek has suffered some sedimentation and Goat Creek has had some overgrazing affects. But by far the main issue with sustainability of bull trout is cold water availability. Stocks in Crater, East and West Fork of Buttermilk, Reynolds, Goat, North, Cedar, and Monument Creeks have very limited reaches of suitably cold water and their threaten listing is justified. Stocks elsewhere have greater reaches of cold water and they are secure in the short term. The most secure stock is the resident stock in Early Winters Creek above the barrier falls, preventing an invasion from downstream.

Over the long-term brook trout provide grave risk. Cold water does not deter brook trout, and they may eventually penetrate headwater refugia. For example, brook trout are found at very low levels in the Twisp mainstem and there are no passage barriers to obstruct them from invading the bull trout zone upstream. They don't expand rapidly in the mainstems because of interactive suppression, but they will explode once they get above those species. Brook trout should be eliminated in War Creek by chemical means, the creek from which recruits systematically enter the mainstem Twisp. War Creek above the falls can be restocked with native resident rainbows and westslope cutthroats. Eightmile Creek should be treated chemically to remove brook trout and then restocked with bull trout and resident steelhead. The same procedures should be applied to the Beaver Creek when bull trout finally succumb to introgression with brook trout. The source for bull trout for restocking are those (fluvials) stranded in the Methow between Lost River and Early Winters Creek or resident fish captured above the falls in Early Winters Creek.

There is little fishing on resident stocks because access is difficult and fisheries are restricted. Heretofore, angling mortality was probably the most limiting factor for migratory fish because many over wintered in the mainstems where intense steelhead angling took many incidentally via poaching and hooking mortality. Now that steelhead fishing has been discontinued, these fish will enjoy improved survival rates.

Parr and immature fish of migratory bull trout rear in downstream reaches and are subjected to habitat conditions they encounter there, and they will respond accordingly to improvements or degradation. This is not a significant limiting factor now, but this could change without careful, systematic protection.

Coho Salmon (p 7 of 17)
Coho spend 18 months (egg to smolt) in freshwater.

The first 5 sentences of the third paragraph should be eliminated because they pertain to coastal coho, which are vastly different than inland coho, as much so as winter steelhead differ from summer steelhead. These differences need further elucidation. Long-run coho are unique among a species that usually migrates very short distances to spawn in freshwater. That explains why the use of coastal short-run coho fails today.

The first sentence in paragraph 4 is a platitude, as all salmonids are affected by inadequate habitat.

Mullan's estimate of coho was 15,000-31,000, not 23,000-31,000. Some of the coho counted at Rock Island Dam were destined to pass what was to be Grand Coulee Dam. The Methow stock was already extirpated during this time frame, so none were returning there.

Summer Chinook
Yes, summer chinook have an advantage by exiting the freshwater earlier than the other anadromous species, but this is hardly proof that low fall flows—implying negative affects of irrigation—limit spring chinook because those that spawn and rear above irrigation are not outperforming than those using downstream sites. It should not escape notice that LWD is extremely scarce where summer chinook rear and that this condition has not materially changed since settlement.

There is more to the story than just that summer chinook has not been listed. NMFS studied the status of summer chinook and concluded that the runs were stable and listing was unmerited. Where are the views of Mullan et al. (1992) and Chapman et al. (1995)?

I dispute the claim that summer chinook runs have declined dramatically in the Methow since 1967. Mullan et al. (1992) estimated that from 1967-87 mean escapement and run size was 3,385 and 19,350 fish, respectively. The authors are confusing run size with escapements and missing the fact that over-fishing remains a major concern with summer chinook. Missing this point encourages the tacit conclusion that habitat is the key limiting factor. The short-term depression of run size is illegitimate in determining run status, a point NMFS was forced to choke on as they witnessed the near-record spring chinook run (post Bonneville Dam) subsequent to their obituary for this species. The depression of nearly all anadromous salmonids in North America is not mentioned. Neither is an opinion ventured as to the significance of the invasion of mackerel to the Gulf of Alaska and blue marlin sightings in Puget Sound on salmonid survival. Someone should tell David Thompson, who was forced to eat his horse instead of salmon steaks at Kettle Falls in August of 1811 when summer chinook failed to show, that the runs in 1991 and 1992 were record lows.

Spring Chinook (p 11-13 of 17)
Extended freshwater rearing not only makes these fish more susceptible to habitat degradation by man it also makes them more susceptible to natural limitations.

What's the significance of WDFW making no distinction in status between summer and spring chinook while NMFS lists spring chinook as endangered? Why are all dissenting views (Mullan et al. 1992 and Chapman et al. 1995) dismissed?

Spring chinook juveniles disperse into the <u>mouths</u> of adjacent tributaries. Mullan et al. found age-0 chinook above the "barrier" culvert on lower Little Bridge Creek.

The Rock Island Dam counts in the 1930s included an undetermined number spring chinook originating above the future site of Grand Coulee Dam.

The controversy over spring chinook status and the factors that limit them is not beyond the scope of this paper; it centers at the very heart of this report.

Spring chinook counts over Wells Dam date back to the mid-1960. Why did the trend analysis start at 1977 with a large count and exclude the low counts of the 1960s? There is no long-term downward trend of spring chinook. The most one can say is that there are low numbers in the 1990s. The resurgence of fish in 2000 provides a powerful reason why a short-term "peek", as irresistible as that might be, is a slippery slope for predicting irreversible death spirals.

Summer Steelhead (p 13-17 of 17)
Summer steelhead spawn in late winter, spring and early summer. Summer steelhead don't dominate inland waters, they are the exclusive ecotype. Most Methow origin adult steelhead overwinter in the Columbia, but a few may remain in the Methow. A higher percentage of Wenatchee steelhead overwinter in the Wenatchee because that river is larger and Lake Wenatchee moderates temperatures.

Mullan is misspelled in the last sentence of paragraph of page 14.

WDFW assessed the wild population of steelhead as depressed. They (I authored the Methow/Okanogan sections of the SASSI report) did not consider the status of hatchery steelhead or whether wild steelhead were actually the progeny of hatchery spawners. NMFS listed both natural and hatchery steelhead as endangered.

Mullan et al. (1992) identifies the anadromous zones in the Methow (see Tables 6 and 7 vs Table 8). I have witnessed many steelhead spawning in the Methow mainstem and tributary streams. Spawning and rearing distributions correlate closely.

Mullan et al. (1992) state that ecotype is a function of the environment and that the two ecotypes are genetically indistinguishable.

In Wolf Creek resident steelhead extend to the North Fork (RM 5.9), not the barrier falls at RM 10.3. Anadromous rearing occurs in lower South Fork of Gold Creek, but the resident ecotype was found at the Rainy Creek confluence.

The fourth paragraph on page 16 grossly misrepresents the facts. Spawning escapements and run size (to Astoria) are confused, as is the distinction of wild and hatchery components of the runs. The claim is that the runs were "virtually gone", but what is the point of reference for such a claim, i.e., how many fish are needed to fully seed the spawning habitats above Rock Island Dam. Mullan et al. (1992) answered that with their spawner-recruit analysis that showed that an escapement of 4,904 fish produced on average 16,041 recruits at MSY. From the 22-year period between 1933 to 1954, the average count past Rock Island Dam was 2,475 fish or 50.5% of the optimum escapement. This hardly represents a run that's virtually gone. On average this escapement produced runs (to Astoria) of 10,176 fish. Further, Mullan et al. (1992) showed that Craig and Suomela under estimated dam counts (page 286). Mullan et al.

(1992) estimated the pre-anglo run upstream of Rock Island including the upper Columbia above Grand Coulee Dam as 32,000-48,000 steelhead in contrast to the 500,000 fish estimated by Scholz et al. (1985) for the upper Columbia (above Grand Coulee Dam) alone.

The advent of hatchery production after 1933 is a great overstatement; the production at the federal hatcheries (Grand Coulee Fish Maintenance Project) was short-lived (5 years) before Wells Hatchery came on line in 1966. Steelhead runs did not decline after 1933 Mullan et al. (1992) (Table 1, Appendix H). From 1941-54 the run tripled (Fig.5, Appendix H) and continued to increase until the early 1960s. Wild steelhead did not decline until the mid-1960s when hydropower development was complete. Returns of naturally produced adults since then have been severely, consistently depressed (Fig. 3, Appendix H). But when both naturally produced and hatchery fish are combined there has been no long-term trend of decline. Record lows occurred in the 1970s, not the 1990s. Further, the forecast for 2000 promises a large run in response to improved ocean conditions.

The Northwest Power Planning Council escapement goal of 1,500 fish for the Methow was a number that I pulled out of my hat before I did a more comprehensive analysis in Appendix H of Mullan et al. (1992). The better MSY spawning escapement for the Methow is 2,212 fish, which historically yielded a run of about 50,000 smolts and 7,234 adults (page 291, Appendix H).

The naturally produced component of escapements averaged 6.0% between 1982-89 (Table 3, Appendix H). The estimate of Busby et al. was the result of selective harvest of hatchery fish by anglers. This fishery is now terminated and spawners on average are about 94% hatchery-origin.

The statement that hatchery planted smolts compete with natural fish is academic if the Methow is gravely underescaped, if those natural fish are actually the progeny of hatchery parents, or if the fitness of progeny from hatchery parents does not differ significantly from that produced from wild parents. How could there be such a thing as a wild fish in view of the swamping affect of 15.7 hatchery spawners for each “wild” spawner for the past 33 years? A preponderance of hatchery spawners in the mid-1980s, when spawning escapements exceeded MSY level, produced the estimated 50,000 smolts needed to fully seed the Methow basin at MSY. It should be noted that this estimate was made from real fish, not the electronic kind produced from computerized models. This suggests that hatchery spawners are producing most of the natural recruits, hatchery fish remain reasonably fit, the environment remains reasonably fit, and that the habitat is being utilized at near capacity on most years.

The “pied piper” effect occurs when hatchery age-0 chinooks are released not when age-0 steelhead juveniles are released (Mullan et al.1992). Since no age-0 steelhead are released, the point is moot.

Are the authors suggesting that hatchery smolts not be used to supplement natural production? Do they have an answer to the question of what would happen to the steelhead run if hatchery production was terminated?

The mixing of stocks at Rock Island dam form 1939-43 would produce hybrids only if the forced domestication at the federal hatcheries produced fish that actually survived. The authors have previously claimed that these hatcheries contributed to the demise of coho. Did the hatcheries do better with steelhead? Between 1933 and 1961 the lowest number of recruits occurred during the 1939-43 period of domestication (Mullan et al. 1992, p 279). It's well known that steelhead did not become extinct when they were blocked form the river for many years, so even if the hatcheries produced no recruits then it does not follow necessarily that the run would be extirpated. I'm not sure what biodiversity means pragmatically or how it plays out at this point in time, but I make a case in Appendix H (Mullan et al. 1992) that Wells hatchery steelhead are productive after many generations of domestication.

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