Salmon Recovery & Local Breeding Populations

A Response to Jim Buchal

By Scott Church

Oct. 26, 2001

This letter appeared in the Holiday Market Online Newsletter (Skagit County, WA) in response to its publishing of an editorial by Industry and Property Rights lobbyist Jim Buchal two weeks earlier.

Editor,

In a recent Holiday Market E-Mail Update (Oct. 15, 2001) there was a partial reprint of an article by Jim Buchal entitled "Environmentalists, Terrorists, Patriotism and the War Against America: A Speech to the Kitsap Alliance of Property Owners". In it, Buchal argues that salmon are not endangered, and that the concepts of distinct population segments and evolutionarily significant units (ESU's) are just lies that the "buffoons that the clueless majority sends to Washington, D.C." have perpetrated on the public. He also argues that fish raised in hatcheries are not meaningfully different from ones bred in the wild, that streamside habitat has little to do with salmon survivability, and that anyone who says otherwise is simply a "powermonger" who wants nothing more than to get people's private property for some undisclosed end. He then attempts at various points to somehow relate all of this to "crazy environmentalists", "morons", "eco-nazis" and even terrorists.

The lack of scientific understanding in these arguments is considerable (not to mention the paranoia). Mr. Buchal appears to have little or no formal understanding of the science of salmon ecology, or for that matter, even how to do basic research and think critically. Furthermore, the hysteria, cheap shots and general immaturity displayed in his comments make this lack of understanding insufferable. His book "The Great Salmon Hoax" also contains many errors, which likewise are the result of poor research, improper or severely out of context citations, and conclusions that do not follow from either his premises or his sources (See Footnote 1). These errors and his confrontational tone both require comment. I apologize in advance for the fact that the references used in what follows are relatively few in comparison with the much larger body of literature on the subject (though they do represent the general consensus of research to date). The sheer volume and severity of the errors in "The Great Salmon Hoax" and this article forbids a detailed treatment of them all in this space (though I hope to provide this in another forum soon). For now, let me just concentrate on Mr. Buchal's statements in the article referenced above.

First of all, let's look at his "science". The concept of the Local Breeding Population he disparages is based on the fact that the health of any breeding population of any species in the wild, including salmon, is determined by the genetic diversity of the population in question. This diversity is driven by genetic mutation, population dynamics, and the action of natural selection on the population as determined by a wide range of environmental variables and symbiotic relationships with the surrounding habitat. Salmon, as we all know, return at maturity to their parent streams to spawn. They return to specific locations in specific streams, and thus breed within specific subpopulations (for instance, in the Skagit River, pink salmon which breed in Illabot Creek are a distinct population from those that would breed in, say Gilligan Creek). Because of homing instinct, these subpopulations (called "Demes" from the same root word demographic is derived from) are the critical determinant of recruitment and biodiversity (Rich, 1939; Ricker, 1972). The persistence of such demes is dependent on recruitment, biological and physical constraints on reproductive potential, and losses due to natural death and fishing. If the recruitment process does not replace these losses, demes can collapse (Sissenwine, 1984). In this process, the distinction between a deme (local population) and a larger stock is critical (Beverton et. al., 1984). This is because breeding only happens within demes that exist within certain habitat regions that have very specific characteristics and vary widely from location to location. It is these characteristics which drive the natural selection process, and thus the genetic diversity of salmon stocks. Within any given deme, genetic mutation will produce a certain amount of diversity, which will be larger in proportion to the population size. Over the course of evolutionarily significant times, a given larger stock of salmon will be

separated into demes by a variety of factors. Each time a deme is separated from a larger metapopulation, only a random sampling of the parent metapopulation's genome will be represented in the new habitat. Typically, through what scientists call the Founder Effect (Mayr, 1942), this "subgenome", which characterizes the deme, will not be fully representative of that of the parent metapopulation. Given the distinct geographic and biological characteristics of the new habitat, evolutionary mechanisms will produce a distinct subpopulation unique to that habitat. This is known as Allopatric Speciation. In the case of salmon, it is actually somewhat more complex than this in that most subpopulations occasionally receive strays from nearby other subpopulations within the larger metapopulation and are thus not fully isolated (Hanski & Gilpin, 1991). The degree to which this happens is driven by geography proximity (Quinn et. al., 1991; Quinn & Pascual, 1994). This allows genetic information from the larger population to enter into demes from time to time, though on a small scale, thus helping to insure genetic diversity.

Within any given such subpopulation, a variety of forms of genetic mutation will increase diversity. In other words, mutation will increase the number of Alleles (separate forms of a gene at any particular locus within the gene) which code for any given trait, harmful or helpful. Most of these traits will be heterozygous within the population (not shared by both chromosomes, and thus not expressed in a trait). Against this, breeding within the population will tend to drive the genetic diversity toward homogeneity, and thus to homozygosity, for harmful alleles. This is Inbreeding Depression. Against this background, natural selection will take place, tuning the subgenome of the deme to maximal fitness for the particular geographic habitat where the population spawns and nurses, and for the spawning journey back to this habitat at adulthood. In addition, a variety of stochastic factors external to the habitat ecology itself (catastrophes, natural and man-made, random dispersion within the genome through breeding dynamics, etc.) act to occasionally disrupt this process in constructive and destructive ways. This adaptation is strongly coupled to local habitat conditions and geographical relationships to the parent metapopulation. An excellent example of this was provided by Bartley et. al. (1992) and the National Research Council (NRC, 1996). They studied the genetic differentiation at 8 loci in 10 subpopulations of Klamath River drainage chinook using electrophoric analysis. Analysis of their data shows statistically significant genetic variation in allele frequencies for all 8 loci occur for each subpopulation. These differences were then shown to be strongly related to geographic proximity (NRC, 1996). Thus, salmon have a complex, highly symbiotic relationship to their watersheds that involves hierarchical relationships between demes (subpopulations) and their larger metapopulations.

Typically, in a population large enough to be healthy, these factors will largely cancel each other and the population will be fit, healthy and well adapted to handle any of the stochastic "catastrophes" described above. But when populations become small, harmful alleles are a much more significant part of the subgenome and genetic drift becomes much more important (the proportion of harmful alleles with respect to positive traits, as determined by natural selection, is called the Genetic Load of the population). Likewise, mutation rates, which are proportional to the population size, will be correspondingly depressed. Thus, as the population shrinks in size, genetic drift begins to win out over positive mutation and the population becomes less capable of adapting to selective pressures in its environment. It becomes "threatened", or even "endangered". Eventually, if the population falls to a critically low level, it will no longer have the genetic information or population size to negotiate any of these natural pressures and the population will be lost. Typically, when any species goes extinct, it is not because the last member was hunted or fished out – it goes extinct because the population grew too small to genetically resist a cascade of natural and anthropogenic events which kill off the remaining numbers.

This is a key point. Salmon populations do not go extinct because they are fished out. *They go extinct because natural, and more commonly, anthropogenic pressures lower their numbers to a point below viable genetic diversity, and this genetic diversity has meaning only within specific habitats at specific geographic locations.* This is the first point where Mr. Buchal shows his ignorance of life science. He argues that any given subpopulation could be lost without losing the entire "species". Though this is technically true, it is completely irrelevant given actual salmon populations. Pacific salmon "species" are, in fact, defined entirely by the collective sum of their Local Breeding Populations, all of which exist in specific habitats to which they have adapted over many millennia. Very few of these Local Breeding Populations are not at risk to degree. They're *all* in at least some danger, not just one or two. Many are in critical danger, and hatcheries have had little success in replacing what has already been lost (Steward & Bjornn, 1990; Burgner, 1991; Heard, 1991; Ridell, 1993). In fact, due largely to the factors described above, acting on LBP's all over the Northwest, salmon have now disappeared from over 40% of their historical range in Washington, Oregon, California and Idaho in the last

century. If the areas where they are now threatened or endangered are added, less than one third of their historic range has not experienced dangerous losses, and this situation is getting worse with each passing year (NRC, 1996).

Furthermore, Mr. Buchal's shrill rants aside, once a fish representative of a given deme is removed from it's respective habitat to be spawned artificially in a hatchery (such as the Samish hatchery in the notorious photo accompanying the article) it's genetic diversity no longer has a context. That diversity was honed by mutation and natural selection for a completely different set of circumstances which may or may not be compatible with the environment it has been moved to. Fish well adapted to a tributary of the Upper Stillaguamish, for instance, may not be as viable for the lower Samish, or vice versa. Also, since timing of runs as a function of geographical location is often an important part of subpopulation adaptation (Brannon, 1987; Burgner, 1991), a chum salmon adapted to spawn in the upper Skagit near Marblemount won't necessarily do well in a breeding population from the Lower Skagit (this is particularly true because homing plays such a crucial role in subpopulation recruitment). Issaquah Creek chinook, which depend on lake nursery areas like Lake Sammammish, might not do as well in either situation. In general, separating a fish from the environment where it's genotype has evolved will significantly reduce the advantages it provides. The fact that the fish being clubbed in the article's notorious photo (see Footnote 2) was genetically part of some threatened population was meaningless, because the fish was no longer in the habitat where it's genetic makeup was precious (which is why hatchery workers don't generally worry about clubbing them to get eggs). Furthermore, since hatcheries tend to promote inbreeding depression, after a few generations, much of that genetic uniqueness will be lost anyway, and it will be lost at least 3 to 4 times faster than evolution can replace it. This is a large part of why hatcheries have generally been unsuccessful at restoring fish populations (Steward & Bjornn, 1990; Burgner, 1991; Heard, 1991; Ridell, 1993). Furthermore, decadal variations in North Pacific feeding grounds can mask the seriousness of these problems in the short term. Such variations, driven primarily by ENSO and PDO (El Nino Southern Oscillation and the Pacific Decadal Oscillation) – large scale low frequency temperature fluctuations which are in turn are thought to be driven by large scale climate change effects and the thermohaline cycle of the open ocean - lead to shifts in deep upwelling of nutrients that directly affect the fecundity of the open ocean food chain (UNESCO, 1992). These decadal shifts can have a profound effect on the survival and growth rates of salmon populations, and thus on returning adults (Francis & Sibley, 1991; Beamish & Bouillon, 1993; Francis & Hare, 1994). Such decadal variations can temporarily (repeat, *temporarily*) mask the effects of the problems described above (Lawson, 1993).

Mr. Buchal appears to be completely ignorant of all this. After addressing the subject of Local Breeding Population, he then takes up the subject of riparian habitat and property ownership. In a particularly hysterical rant, he states that,

"Nothing is going to change until you people wake up and start fighting. It doesn't take much. It just takes an angry mob to start showing up at these meetings and saying who the hell are you to tell me I can't remodel my house the way I want because of some fish? Are you people nuts? Do you think fish swim through my living room? Do you think a fish can feel the difference between plowing twenty-five feet away from the water and plowing 125 feet away? Do you think that a fish can tell the difference between whether 'native vegetation' or ordinary lawn grass is growing on your property twenty feet away from the river?"

Well yes, as a matter of scientific fact, they can tell the difference! Not surprisingly, Mr. Buchal is ignorant of this also. Riparian (riverside) habitat is crucial to salmon survival in a variety of ways. Riparian trees provide shade, which helps regulate streambed temperature (ordinary lawn grass does not). Though some increases in streambed temperature may be beneficial to salmon up to a certain point (Hawkins et. al., 1983), significantly increased streambed temperatures stress salmon, and can also lead to the worsening of disease (Fryer et. al., 1976; Groberg et. al., 1978). At a certain point, they cannot survive at all. Higher temperatures also favor predation of salmon by various warm water species (Brown & Moyle, 1990). The amount of necessary riparian vegetation for any given streambed is, among other things, a function of the height and type of vegetation present. For instance, Spence et. al. (1996) argued that no commercial timber harvest take place within one site potential tree height of a stream (i.e. greater than 200 feet on either side) when a stream is over its normal range of temperature variability. Riparian vegetation contributes significantly to streambed woody debris, which is critical to habitat complexity and stream flow moderation, and provides sanctuary for smolts (Reeves et. Al., 1993). It provides biomass that supports the streambed food chain, stream bank erosion stabilization, helps maintain channel form and in-stream habitat through restriction of sediment input or slowing sediment moving

through the system, filters sediment, chemicals and nutrients from upslope sources, and moderates downstream flood peaks through temporary upstream storage of water (KRIS, Online). It makes an enormous difference to salmon populations whether there is old growth Douglas fir or fertilized and pesticide treated lawn next to their stream!

At this point, Mr. Buchal takes off on a roller coaster of diatribes about “crazy environmentalists” (whom he compares to terrorists in one of the silliest and most immature non-sequiters I’ve ever personally encountered), “flag haters”, Kitsap County supposedly turning high school students into “little eco-nazis”, CBS (whom he refers to as the “Commie Broadcast System”), the CIA and Congress “spending money like drunken sailors”, and “powermongers” who have supposedly taken over science. What any of this has to do with the science of salmon ecology or proper salmon management remains to be seen, and Mr. Buchal, of course, never gets around to showing us. Along the way we are treated to a story about one “Mr. X” who did research which supposedly “proved” that habitat was only a small factor in salmon survival and, we are told, was unfairly castigated and rejected for publication by the so called “powermongers”. Naturally, we never find out who this “Mr. X” actually is, nor is the content of his work presented where it can be examined. Yet Mr. Buchal expects us to take his word for it anyway without further thought. Until he bothers to provide any evidence demonstrating the credibility of Mr. X’s research, it’s at least as likely as not that his work was rejected for publication because it was poorly done and didn’t pass muster.

We are also treated to diatribes about how Al Gore supposedly “had the CIA using intelligence satellites to do environmental assessments of sea turtles and dolphin schools” and people who supposedly “think that it's more important to prevent a helicopter from scaring endangered fish than to save the lives of those who fight forest fires”. Like nearly everything else in this article, these statements are both flatly incorrect. In reality, Al Gore pushed for declassification of *existing* pre cold war satellite images in 1995 - *several years after they were actually taken*. These were then used for a wide variety of things, including environmental research (New York Times, Feb 25, 1995). At no time whatsoever was there any appropriation of currently operating satellite assets away from intelligence tasks for any reason.

The remark about helicopters scaring endangered fish refers to the incident involving a helicopter delivering water to last summer’s 30 Mile Fire near Winthrop in which 4 firefighters died. In actual fact, the original concerns were over whether water should be taken from a stream with critically low flow, not "scaring fish". Furthermore, later investigations by the U.S. Forest Service proved that the loss of life was the result of safety rule violations and poor planning by firefighting teams at the time, and not related to any policies or actions regarding water deliveries by helicopters (Seattle Times, Sept. 27, 2001 – The full contents of USFS report can be read online at www.fs.fed.us). Incidentally, when I decided to check Mr. Buchal on these particular points, I was able to find accurate information for each story in less than 10 minutes. Obviously, he didn’t bother with even that much effort.

As can be seen from the few examples discussed above, this article is full of scientific and journalistic errors, and a general carelessness with facts. The errors made are serious ones – errors which any responsible attempt at scholarship should have exposed and corrected. Yet Mr. Buchal not only presents them, he does so in an extremely venomous and confrontational tone using hysteria (e.g. calls to form an “angry mob”), cheap shots (e.g. “Commie Broadcast System”, “eco-nazis”), and downright adolescent immaturity. As if this weren’t bad enough, he also maintains a blatant conflict of interest in the issue by providing legal representation to industry, agribusiness, and property rights groups whose interests frequently conflict with those of salmon recovery, and he is being paid handsomely for it. Given the value of these fish to all of us, and the critical need for objectivity and professionalism in our efforts to save them, this conflict of interest, and his poor scholarship and rudeness, are unconscionable.

This is the second time a hysterical diatribe with little or no basis in fact has appeared in this forum in the last 3 months (the last was a commentary from the Wall Street Journal printed in the July 25 Newsletter). In the past, this forum has been, in my opinion, very informative and a great force for the good of fish and game. It will be a crying shame if this sort of juvenile behavior and unprofessionalism becomes a regular feature here. So if I might, I’d like to suggest some guidelines for evaluating future contributions about the fish and wildlife we all care about to this, or any other forum.

- Hysteria is *not* a substitute for reason. Contrary to the belief of many, truth is not fragile, and will stand up to an honest inquiry. It follows that, in the long run, proper presentation of evidence and critical reasoning are all that's necessary to make a point. We know today that the Earth is not flat. That's because those who believed it was were not able to defend their case with evidence as well as those who said it wasn't – *and rants about Round Earth preaching "commies", "flag-haters", "eco-nazis" or "buffoons that the clueless majority sends to Washington, D.C." would not have helped their case*. Those who need to resort to such cheap shots to defend their beliefs do so because there is no good evidence for those beliefs, and they have neither the knowledge base nor the maturity to defend them in a more credible manner.

- Conflicts of interest do **not** serve the search for truth. Proper research requires objectivity. As long as a researcher has a vested interest in a particular outcome (particularly a financial interest), their research is likely to be skewed. Salmon research is best conducted by scientists whose primary interest is salmon research, not those who's interest in it is secondary to a passion for property rights, agriculture, industry, Communist Party or Earth Liberation Front attacks on these interests, or any other agenda not related to the science. This is especially true if, like Mr. Buchal, they're on the payroll of such interests. This is not because property owners or farmers don't have rights. Nor is it because they don't bring something valuable to the discussion and recovery efforts. Obviously, they do. But their interests are often different from those of salmon, and sometimes very different. When a conflict arises, they, like anyone else, will be hard pressed not to slant evidence in their favor. This is painfully clear in the content of Mr. Buchal's article and in "The Great Salmon Hoax", both of which are rife with partial and out of context evidence, non-sequiters, and other forms of bad reasoning (Footnote 1). When this happens, salmon and steelhead suffer, and so do we. Responsibility for fisheries science should be left with fisheries scientists, not special interests. Mr. Buchal's baseless rants to the contrary aside, they are by far the most qualified to evaluate conflicting claims and evidence, and they are paid by universities or tax payer funded government agencies, not communists, radical advocacy groups, big agribusiness and timber, or any other special interest group with an axe to grind and/or cash to pocket.

- Quality research is inductive, not deductive, and is broad based. Knowledge grows by the presentation and testing of ideas. In science, this is referred to as Peer Review. Ideas are published and tested against the larger body of knowledge. Ideas which have already been widely demonstrated to be false are rejected. Those which survive further tests and refinements are accepted. Pros and cons are voiced, ideas are tabled, and the knowledge base grows, incorporating pros *and* cons. What makes this process work, is the context of the larger body of existing knowledge and the exposure of all research to a large and diverse community of scientists from a broad range of backgrounds and belief systems who seldom, if ever, share the same interests or prejudices as any given one of them. Proper research is never based on just one or two papers by one or two scientists, or on an absence of dissent. The mere fact that someone can dig up a single paper somewhere that appears to support an idea or express dissent against one, means little without the larger context of the existing knowledge base. Anytime someone defends an idea with extreme and even sarcastic certainty, claiming to be the "lone voice of reason" amidst a sea of researchers, and yet offers a small amount of incomplete evidence in their defense, we should be immediately suspicious.

Imagine, if you would, the following scenario. An individual (John Doe, let's say) decides he's concerned about issue "A" – an issue that has been extensively studied by a large community of researchers who have been publishing for decades, and for which there is a large and well tested body of literature. After doing some research, he decides to write a book about it and do some public speaking. We are told by many loud and faithful proponents that his book is a "seminal work" that reveals new and never before known information about "A". However, upon further investigation, we discover the following,

- His research is highly selective, ignores large amounts of easily accessible data, and goes directly to a particular conclusion with little or no attempt to incorporate the wider knowledge base. He shows virtually no tentativeness in his conclusions, and solicits no independent tests of his work.

- He has little or no formal training in the subject matter.
- His writing is full of hysteria, tantrums, paranoid accusations of persecution, and calls for "angry mobs" to go into battle. Even the title of his book has grandiose superlatives – "The GREAT "A" HOAX!" He is openly contemptuous of the scientific peer review process, and often refers to those who disagree with him as "commies", "eco-nazis", "buffoons", "morons", and other adolescent cheap shots.
- His views are overwhelmingly more likely to be discussed in confrontational special interest forums that have a vested interest in particular conclusions than they are in the "A" research community. He seldom, if ever, submits to having his work reviewed by peers.
- He is being paid handsomely to work for, provide legal representation to, or lobby for one or more of these special interests.

Folks, there are very few pseudoscientists or even religious extremists in the world who don't display one or more of these characteristics. A list like this should set off every BS detector we have. Particularly when something as precious and irreplaceable as fish and game are involved. As a sportsman and a citizen, I feel compelled to emphasize, once again, that when it comes to salmon and steelhead recovery, there is no room for hysteria, cheap shots or propaganda. Solutions to fish declines *must* be solved with science, reason and mature dialog! We're all adults - shouldn't this be obvious? I think we all agree that fish and wildlife are precious. We all want to see them recover and remain healthy for our children's children. But if Mr. Buchal's careless research habits, paranoia, and "angry mobs" are allowed to rule the day - if reason and maturity are cast aside, we will eventually *lose* this resource and we will all be poorer for it. As a sportsman and a concerned citizen, I beg everyone to please not encourage this kind of behavior! The fish can't afford it and neither can we. Let's all work together, be reasonable, like adults, and for heaven's sake, let the scientific process do the talking! Thank you.

Sincerely,

Scott Church

Footnotes

1) Though a detailed examination of the poor reasoning in "The Great Salmon Hoax" is beyond the scope of this letter, a couple examples ought to suffice. First, Mr. Buchal argues in the book that those who criticize the Grand Coulee dam for cutting off salmon runs to the Upper Columbia neglect to mention that those runs were already in decline when the dam was built. This is like arguing that it's perfectly alright to shoot a critically ill hospital patient between the eyes because, "hey, he's probably going to die anyway, right?", therefore shooting him isn't murder. This does not follow. Furthermore, he neglects to mention that a large factor in those declines was the very sort of habitat destroying activity practiced by the industry and agribusiness interests he provides pricey legal services to. Elsewhere, he argues that fisheries scientists studying squawfish predation behind Columbia Dams ignored evidence that squawfish also prey heavily on salmon fry away from the dams when they're planted there. This begs the question. The issue on the table was whether or not dams increase existing squawfish predation of salmon fry by altering habitat in ways that favor squawfish. Whether or not squawfish prey on salmon elsewhere does not bear on this point. As can be seen, neither of these conclusions follows from the evidence Mr. Buchal presents. This sort of fallacious reasoning occurs throughout the book.

2) The original printing of this speech in the Newsletter where this appeared was accompanied by a photo of a hatchery employee clubbing a salmon to death at the Samish River salmon hatchery in northern Washington before taking it's eggs. Buchal made much of this in his speech, attempting to argue that it was inconsistent and immoral for those concerned about "endangered" salmon to be clubbing them. This argument is equivocal. It redefines the word "endangered" to mean something useful to the conclusion he wants us to draw rather than how it actually is used by the fisheries scientists and ecologists he is attacking. It also assumes his faulty premise that hatchery and wild salmon are indistinguishable, which as we have seen, is not supported by the science.

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