Mark Stopher
California Department of Fish and Game
601 Locust Street
Redding, CA. 96001
dfgsuctiondredge@dfg.ca.gov
1 May 2011

Dear Sir:

I appreciate the opportunity to comment on the California Department of Fish and Game's (DFG) Suction Dredge Permitting Subsequent Environmental Impact Report (SEIR) and Proposed Regulations.

I am a retired Civil Servant and Food Service Professional that worked for the Army and Air Force Exchange Service for 26 years, providing restaurant programs on US Military bases around the world.

One of my best and most exciting retiree hobbies has been recreational dredging, mostly in Colorado and Wyoming. In 2009 I had a 2-week trip planned for a dredging trip to California that was cancelled due to SB 670. I lost over $150 in associated costs and an additional $185.25 in a CA. dredge permit #400095-04. To say I was disappointed and upset is an understatement. Since then, I have watched the progress of the SEIR and am making plans to visit CA. with a friend in Denver, so that we may enjoy suction dredging in your Golden State.

I have spent many hours reading thru the extensive SEIR, numerous scientific reports and the input of others. What I have found, after all of the time I have spent on this issue is that the conclusions for the effects of suction dredging on fish are the same as those found in the 1994 EIR.

The directive of the court was to identify any suction dredge issues that were detrimental to fish and since harm to fish is no longer the issue, according to the findings in the SEIR, and DFG only has the legal authority to require mitigation on the impact on fish and amphibians, the entire study results and proposed program should be changed to

the 1994 Regulations alternative. I have attached a copy of SEIR input from Claudia Wise and Joseph Greene, retired U.S. EPA Scientists that support the 1994 Regulations alternative.

There is insufficient evidence in the SEIR, the science doesn't support the proposed increased suction dredge restrictions, and the study writer used creative journalism to fabricate conclusions. I have never seen so many could have, may cause, may have, could impede and could result statements in a scientific study that were used as a conclusion to restrict an activity! If those statements were all that were required to curtail human activity, we would be forced to live in plastic bubbles.

William Moore
2025 N. Greyrock Rd.
Laporte, CO. 80535
Tel (970) 482-6508
bmoorewi@aol.com

4 Attachments

Mark Stopher
California Department of Fish and Game
601 Locust Street
Redding, CA 96001
dfgsuctiondredge@dfg.ca.gov
28 April 2011

RE: Comments regarding SEIR and Proposed Regulations for suction dredge mining in California in Favor of Maintaining Current 1994

Dear Sir:

Thank you for allowing us the opportunity to comment on the California Department of Fish & Game's (DFG) Suction Dredge Permitting Program Subsequent Environmental Impact Report (SEIR) and Proposed Regulations.

I, Claudia Wise, and Joseph Greene are retired U.S. EPA Scientists and invited members of the CDFG SEIR Public Advisory Committee. During the PAC meetings we presented two science based PowerPoint presentations to the committee "Selenium Antagonism to Mercury, Does Methylmercury Cause Significant Harm to Fish or Human Health?" and "Turbidity and the Effect of Scale".

Claudia Wise is a retired Physical Scientist previously employed at the U. S. Environmental Protection Agency, Corvallis Environmental Research Laboratory, Corvallis, OR. I have 29 years experience in chemical and biological instrumentation methods. I spent 8 years with the Western Fish Toxicology Station coauthoring journal articles dealing with bioaccumulation in Invertebrates and Fish exposed to chemical toxicants. I have contributed to many projects and coauthored numerous journal articles for the Watershed Ecology, Terrestrial, Ecotoxicology and Freshwater Branches where I researched toxicity in soil and the effects of toxicants on plant growth. At the time of my retirement, I was with the Watershed Ecology Stable Isotope Research Facility. I am a recipient of the United States Environmental Protection Agency Bronze Medal for Commendable Service.

Joseph Greene has over 30 years of national and international professional experience including consulting, research, and teaching for industry and government regulatory agencies. Activities included project management, contract administration, experimental design, preparation of research reports and technical documents, laboratory supervision, statistical analysis of data, computer simulation, development and application of biological methods, and performance of algal growth potential and aquatic and terrestrial toxicity tests.

Consulting experience included assessment of nutrient pollution in freshwater canals and rivers, assessment of heavy metals toxicity from mining activities and paint stripping, investigation of toxicity and bioaccumulation in soils at military facilities, evaluation of water soluble and soil toxicants at Superfund sites, and assessment of algal toxicity from textile dyes.

Research activities included establishment of an ecotoxicology laboratory, development of a biological-chemical-physical protocol for measuring potential toxicity of construction materials, development of internationally standardized test methods (aquatic algae, aquatic macroinvertebrate, terrestrial plant and terrestrial invertebrate), chairman of testing committees for ASTM and Standard Methods, platform chairman of several international symposiums, workshops, and congresses, and invited speaker to numerous national and international professional scientific meetings.

Teaching experience included a number of short courses and workshops on performance of algal growth potential and interpretation of results across the nation, a workshop on environmental analysis techniques in Europe, a workshop on complex problems with point and non-point sources of water contamination for the US Department of the Interior, and an environmental engineering graduate seminar on toxicity testing for environmental engineering applications.

Government agencies experience included project management, experimental design, hands-on research, data analysis, and report writing.

Since retirement both of us have participated, as a team, to defend the rights of small scale suction dredging using science to establish the "Less Than Significant effects of the practice. Joseph Greene primarily investigated biological effects and Claudia Wise investigated water quality effects. Post USEPA experience includes a Preliminary Klamath River Water Quality Survey examining surface water temperatures.

According to the DFG Suction Dredge Permitting Program SEIR NOA (SCH #2005-09-2070) regarding the Notice of Availability of a DSEIR for Suction Dredge Permitting Program (SCH#2009112005), "The Draft SEIR evaluates the potential environmental impacts of the proposed program and four alternatives:

No Program alternative....;

1994 Regulations alternative...;

Water Quality alternative (which would include additional program restrictions for water bodies listed as impaired pursuant to the Clean Water Act (CWA) section 303(d) for sediment and mercury); and,

Reduced intensity alternative (which would include greater restrictions on permit issuance and methods of operation to reduce the intensity of environmental effects).

It should be noted that the directive of the court was to identify any suction dredge issues that were detrimental to fish yet the CADFG paid the contractors to spend an inordinate amount of time evaluating situations that were never a part of the court order. If any of these additional findings were to be enforced they could keep small scale suction dredgers from plying their trade and earning income.

During the court proceedings, which ordered the development of this SEIR, the attorneys for the CDFG told the court that they had scientific information that small-scale suction dredging might be harmful to fish. It should be noted that during discovery by the agents of the miners the CDFG attorneys refused to provide the scientific evidence they claimed was in their possession. Therefore, under court order, CDFG is spending a large amount of tax dollars to find scientific data that dredging harmed fish....data the State claimed to have in its possession prior to the court ordering the SEIR study be performed. And yet, the contents of the SEIR illustrate that the effects of suction dredging on fish, in every instance, is "Less than Significant". The SEIR results also illustrate that the State never possessed any additional scientific evidence they claimed would prove small-scale suction dredging was detrimental, in any way, to fish or wildlife beyond the data already analyzed in the 1994 EIR. The public's money could certainly have been used more productively, in a cash strapped State, than having it used to try and destroy an economic sector of a State already in financial trouble. The basis for the entire SEIR process was founded upon a lie presented by the State's attorneys.

The conclusions for the effects of suction dredging on fish are as follows and are the same as those found in the 1994 EIR and support the positions that the miners have always argued:

☐ Impact BIO-FISH-1: Direct Effects on Spawning Fish and their Habitat (Less than Significant)
☐ Impact BIO-FISH-2: Direct Entrainment, Displacement or Burial of Eggs, Larvae and Mollusks (Less than Significant)
☐ Impact BIO-FISH-3: Effects on Early Life Stage Development (Less than Significant)
☐ Impact BIO-FISH-4: Direct Entrainment of Juvenile or Adult Fish in a Suction Dredge (Less than Significant)
☐ Impact BIO-FISH-5: Behavioral Effects on Juvenile or Adults (Less than Significant)
☐ Impact BIO-FISH-6: Effects on Movement/Migration (Less than Significant)
☐ Impact BIO-FISH-7: Effects on the Benthic Community/Prey Base (Less than

Significant)
☐ Impact BIO-FISH-8: Creation and Alteration of Pools and other Thermal Refugia (Less than Significant)
It is generally accepted that most of the pools made by small scale suction dredges last only until the following winter high water flows arrive. In the meantime they serve the fish as resting areas and safe locations from predation. The pools may or may not intersect cold ground water or hyporheic subsurface flows. This fact does not negate or makes the pools less beneficial to the survival of salmonids. The pools still serve as resting and protective locations between thermal refugia, that are generally located at the mouths of confluent streams that could be located some miles away.

We disagree with the Less Than Significant conclusion and would recommend that it be changed from Less than Significant to Beneficial.

Dredge holes 3 feet or deeper are considered adequate refugia for fish. Excavating pools could substantially increase their depth and increase cool groundwater inflow. This could reduce pool temperature (Harvey and Lisle 1998). If pools were excavated to a depth greater than three feet, salmonid pool habitat could be improved. In addition, if excavated pools reduce pool temperatures, they could provide important coldwater habitats for salmonids living in streams with elevated temperatures (SNF, 2001).

☐ Impact BIO-FISH-9: Destabilization/Removal of Instream Habitat Elements (e.g., Coarse Woody Debris, Boulders, Riffles) (Less than Significant);
☐ Impact BIO-FISH-10: Destabilization of the Stream bank (Less than Significant);
☐ Impact BIO-FISH-11: Effects on Habitat and Flow Rates Through Dewatering, Damming or Diversions (Less than Signigicant).

Since harm to fish is no longer the issue, according to the findings in the SEIR, we will address the issues that were identified as "significant and unavoidable". They are:

Impact WQ-4. Effects of Mercury Resuspension and Discharge from Suction Dredging (Significant and Unavoidable);

Impact WQ-5. Effects of Resuspension and Discharge of Other Trace Metals from Suction Dredging (Significant and Unavoidable);

Impact CUM-8. Cumulative Impacts of Resuspension and Discharge of Other Trace Metals from Suction Dredging (Less than Significant);

If these subject areas were important enough to investigate, and expend public funds, they should be analyzed in the proper light that peer-reviewed scientific analytical standards demands. It is stated in the notice of availability that "The analysis found that significant environmental effects could occur as a result of the proposed program (and several of the program alternatives), specifically in the areas of water quality, and toxicology, noise, and cultural resources. Although CDFG does not have the jurisdictional authority to mitigate impacts to these resources, they were, nevertheless, identified as significant and unavoidable."

In Chapter 4.2, WATER QUALITY AND TOXICOLOGY of the DSEIR the first issue of significant and unavoidable impact is "Impact WQ-4. Effects of Mercury Resuspension and Discharge from Suction Dredging (Significant and Unavoidable)".

You have provided no direct dredging evidence to support this! You state, "Few dredge studies are available regarding how small scale suction dredging specifically affects mercury. However two important, high quality studies present results indicating less than significant effects.

A cumulative study using an 8 and 10-inch dredge (actually operating in a flowing river) commissioned by the USEPA (1999) produced values of dissolved mercury that were actually greater upstream of the dredge, suggesting that any effect of the dredge was likely within the range of natural variation. The operator reported observing deposits of liquid mercury within the sediments he was working. This is the most relevant piece of published scientific evidence, addressing dredging at intensity beyond that typically experienced in California, with real world interceptions of occasional mercury deposits. The draft fails entirely to explain how any other information undermines the conclusions of this study.

Humphrey (2005) demonstrated that at least 98% of the mercury was retained in the sluice box of the dredge. The fact remains that most suction dredgers do not find mercury hotspot's. Most dredgers report seeing only occasional drops of mercury or amalgamated gold...if any. The highly infrequent nature of mercury interceptions confirms the lack of significance.

Humphreys (2005) and Marvin-DiPasquale (2009) made an attempt to quantify effects of small scale suction dredging on mercury. Their work has added bits of information to the database of known mercury hotspots. However, their work added very little information to the known effects that suction dredges may have on mercury in the "normal" environment. Later attempts to quantify the effects of dredging on mercury (Fleck 2011) were unsuccessful even when:

☐ They skewed the results by intentionally establishing a study directed at the worst case, most contaminated, location in the State of California; and,
☐ Attempted, using data from a non-dredge study, to draw statewide

conclusions "calculating" the movement of greater quantities of mercury from one 8-inch dredge than is moved in an entire year by natural flood conditions.

According to Fleck (2011), "It is important to note that the results presented in this publication were not developed using a full-scale dredge operation." As a matter of fact, other than for the 3 inch dredge portion of the study, no dredge was used!!! The procedure used does not allow for a scientifically acceptable or environmentally realistic calculation of results to be scaled-up quantitatively to reflect what would occur from the outflow of a "real" dredging operation. Fleck further hedged, "The results of the test should be evaluated as valuable information regarding the proof of concept [of site remediation] rather than a quantitative evaluation of the effects of suction dredging on water and sediment in the South Yuba River." (Fleck 2011).

The first significant failure of this project was not returning the funding to the California State agencies when it was determined USGS would not be allow the use of small-scale suction dredges in the river to perform the suction dredge study. Following that decision the main scope of the project was manipulated to provide pre-conceived answers to the questions the State agencies were seeking. These actions have the appearance that the only goal of forcing these data was to provide grounds for the State agencies to control the waters of California by closing areas or placing strict requirements in areas used by suction gold dredgers. All of this would be based on non-peer reviewed grey literature science like the Humphrey (2005) and Fleck (2011) studies. A legitimate scientifically designed study would have a hypothesis that would have been formulated to find the best information based on data, from actual small-scale suction dredge operations. Fleck (2011), makes it clear when he states, "the scope of the study was modified to accommodate concerns by the State Water Resources Control Board and California Regional Water Quality Control Board, Central Valley Region". These concerns could have been laid to rest simply by moving the test site to a more natural segment of the river system rather than staying in the chosen location of a site known to contain the greatest concentration of mercury in California

Fleck (2011, page 5) stated, "The revised project scope replaced the planned full-scale suction-dredge test with study elements 2 and 3, which focused on a more complete assessment of sediment composition and Hg contamination and speciation as a function of grain size, as well as current and historical sources of contamination at the SYR-HC confluence site. The information generated in this study could have been valuable in determining the potential for Hg transport due to dredge activities through simulation (emphases added) calculations."

Fleck (2011) further described his concern for human health stating that, "Ultimately, the importance of the results of this study relate to whether the Hg in the sediment has a negative effect. Potential for a negative effect is closely related to the transport of sediment into the water column where it may become a threat to local users or be transported downstream." Presenting these concerns does not make them true without adding a study element regarding the bioavailability of released mercury, in the presence of naturally occurring selenium, to cause harm. Therefore, we remain without an answer to the question of what negative effects may be generated from any of the sources of mercury contamination on exposed organisms.

The Fleck (2011) study does further disservice to legitimate science by presenting information calculated on data not collected during the study. He stated, "Unfortunately, the rate at which sediment was moved during the dredge test was not quantified during this study, therefore this evaluation is based on qualitative observation only." Flow rates from a dredge are site specific and cannot be substituted for industry flow rates that are used to sell dredges. Knowing this Fleck (2011} concludes "These estimates are, like the previous analysis, dependent on numerous assumptions and estimates and thus possess a high degree of uncertainty."

On the very same project, when a three inch dredge was used, the researchers found no significant level of mercury flowing out of the sluice box. Results of the three inch dredge study are listed below:

☐ Concentrations of particulate total mercury increased in a similar manner as total suspended solids, with concentrations during the suction dredging two times the pre-dredging concentration and three to four times the concentration of the samples collected the following day.
☐ Concentrations of filtered total mercury in the South Yuba River during the dredge test were similar to those in the field blanks (i.e., field control samples).
☐ Dredging appeared to have no major effect on particulate methylmercury concentrations in the South Yuba River during the dredge operations.

Results from this three inch dredge study are the closest data presented in this report that reflect the effects of an honest dredge study. However, these results are of insufficient quality or sample quantity to allow for a conclusion that particulate total mercury will float indefinitely down a waterway as Fleck's (2011) conclusion suggests. In fact, there are peer-reviewed journal articles that provide the necessary data to show this is not the case.

USEPA commissioned a study on the impact of suction dredging on water quality, benthic habitat, and biota in the Fortymile River, Resurrection Creek, and Chatanika River, Alaska (Royer, 1999). The results showed that although total copper increased approximately 5-fold and zinc approximately 9-fold at the transect immediately downstream of the dredge, relative to the concentrations measured upstream of the dredge, both metals concentrations declined to near upstream values by 80 m downstream of the dredge.

It was suggested the pattern observed for total copper and zinc concentration is similar to that for turbidity and total filterable solids. The metals were in particulate form, or associated with other sediment particles. The results yielded a similar effect to what Fleck (2011) found regarding particulate total mercury in the South Yuba Humbug creek confluence. However, the Alaskan data provided a totally different outcome then Fleck leads us to believe resulted from his study that did not use a suction dredge to develop the data.

The Fortymile River suction dredge study, using 8 inch and 10 inch suction dredges, measured the distance the metals associated with the sediment particles moved in the water column before settling back to the bottom of the river. The sediment particles did not float indefinitely as Fleck leads us to believe. Zinc at 7.10 g/cm3 and copper at 8.92 g/cm3 have significantly lower densities than mercury at 13.55 g/cm3. Zinc and copper average slightly more than half the weight of mercury. Yet those elements only floated 80 meters. The only reasonable inference, absent real data to the contrary, is that Hg, which has almost twice the weight of copper or zinc, would, as gravity dictates; sink to the river bottom in a shorter or, at least, no greater distance downstream.

What value is there to the public interest when a federal agency, such as USGS, forms the hypothesis of a worst case scenario regarding small-scale suction dredging based on a study performed without using a suction dredge? A project where no suction dredge measurements were taken will never be a substitute for honest factual data. No one should be allowed to force results from an ill conceived project on the citizens of California as scientific truth.

In the California Department of Fish and Game, February 28, 2011 proposed suction dredge regulations the definition of a suction dredge is as follows:

Suction dredging. For purposes of Section 228 and 228.5, the use of vacuum or suction dredge equipment (i.e. suction dredging) is defined as the use of a motorized suction system to vacuum material from the bottom of a river, stream or lake and to return all or some portion of that material to the same river, stream or lake for the extraction of minerals. A person is suction dredging as defined when all of the following components are operating together:

A) A vacuum hose operating through the venturi effect which vacuums sediment from the river, stream or lake; and,
B) A motorized pump; and,
C) A sluice box.

Below are photographs of the Fleck (2011) mercury hotspot suction dredge and the one hole from which the sample was collected. This single tub of water is what is being used in the SEIR to define mercury contamination from all suction dredges working the waters of California.

And for those unfamiliar with suction dredging the following photograph will reveal that the dredge floats on the water and is intended to vacuum the overburden from the river or creek bottom. The vacuumed material, (i.e., clay, sand, rocks,) pass through a sluice box that captures the heavy materials (i.e., gold, lead, platinum, mercury) while returning the other materials back to the receiving water.

It states in the SEIR that "The effects of Hg contamination from historic mining activities in California are being extensively studied and there is substantial literature regarding Hg fate and transport. However, there are very few published studies specifically addressing the effects of suction dredging on Hg fate and transport processes. Since the time the literature review (Appendix D) was prepared, USGS scientists and Hg experts provided CDFG with preliminary results of their recent research in the Yuba River "which is specifically focused on assessing the potential discharge of elemental Hg and Hg enriched suspended sediment from suction dredging activities. This new information and data from USGS was used in formulating the approach to this assessment of the Program." The statement is followed by the following diagram.

The statement highlighted in red is factually false and is grounds for dismissing any results from this model. We have no criticism of the modeling approach itself as that is outside of our area of expertise. However, anyone that has worked in science and with modelers understands that the quality of the results is predicated upon the quality and accuracy of the input. There is a term for a model that has used bad or questionable data. It is "garbage in, garbage out". This comment does not reflect on the individual providing the model but, only on the quality of information he is provided. If you were to look at the diagram of the conceptual model it is very clear the element "Discharge of mercury from suction dredging", as defined by the above description from the USGS, is entirely dishonest. Furthermore, we must point out that there is not a control sample from the test site itself. Our understanding is that just one hole was flooded and sucked out using a closed circuit device repeatedly recirculating the water (not a dredge) and historical chemistry for the Yuba River was used as the control data. Not scientifically acceptable!

To prove our point we have only to go back to the statement, "USGS scientists and Hg experts provided CDFG with preliminary results of their recent research in the Yuba River which is specifically focused on assessing the potential discharge of elemental Hg and Hg enriched suspended sediment from suction dredging activities." This statement is false. The California State Water Board denied the researchers the right to use an eight-inch suction dredge in the river as the study had planned to do. Therefore, Dave McCracken, the mining consultant, was asked to determine where he believed might be the most contaminated sites for sampling. He did so. A hole was hand dug out on a gravel bar down to the water table. A closed circuit system was then used to suck the fluid and streambed material from the hole into a large container. The same water was circulated from the hole, into the container and back into the hole, over and over again for about an hour. (A second hole was also hand dug from bedrock outside of the active river (having been exposed to oxygen for potentially many years) just downstream from the most contaminated site.

It was these holes and test procedures that resulted in the measured concentration of the mercury being called dredge discharge. From this description it is clear a real suction dredge was not used to provide the results in the study and the materials did not represent the typical river overburden that had been undergoing natural cleaning from years of flushing winter floods. In fact it is stated that, "discharge of Hg from suction dredging was based primarily on field characterization of Hg contaminated sediments (Fleck et al., 2011). Background watershed mercury loading estimates were utilized to compare to suction dredge discharge estimates (Alpers, et al., in prep). There you have it in their words. Study results were based on contaminated sediments outside the river, or from highly-re-circulated water not representative of ordinary dredging in the river and "background watershed mercury loading estimates were utilized" for the control, rather than precise comparative measures in this area known to have atypically high mercury contamination..

Furthermore, the entire discussion in the draft is written as mercury were a highly toxic, irreversible toxin that everyone should be deathly afraid of. This view is totally biased and slanted. It was bad enough to create a model based only on possibility of worst case factors influencing bioaccumulation, but worse still to not incorporate bioavailability considerations of Hg toxicity into the models assessment management evaluation. We do not see any discussion to the vast collection of published peer reviewed articles that support selenium's antagonism to mercury and the resultant detoxification. This data should also be included in any discussion or model which is attempting to fairly represent any toxic effects to fish, wildlife, aquatic organisms and the environment in general

Examiner Columnist Ron Arnold wrote "Where does a regulatory agency run by political appointees find scientists willing to claim their subjective opinion is science? The FWS gets most of its science from U.S. Geological Survey biologists working in a closed loop: FWS gets science from USGS, USGS gets funded by FWS - which assures predetermined outcomes and no dissent. Interesting money trail, so where's Congress and the media?" We believe the information reflected in the Fleck, et al (2011) report should be viewed with this same skepticism. The dredge output conclusions calculated by re-circulating water through a hand dug hole, in the most highly mercury contaminated area known to the State of

California, is the poorest excuse for science we have observed in our combined 60+ years of scientific research.

Intentionally seeking out and targeting site samples from areas containing known extreme levels of mercury contamination, rather than applying a scientific approach of random sampling, and using these data to draw conclusions that affect a whole State's suction dredge industry is unacceptable. Even worse, the study observations were extrapolated to represent a real stream environment where, it is claimed, mercury would float indefinitely. While panning gold concentrates miners frequently see gold floating on the water until the surface tension is broken. But, overburden and oxygenated water flowing off the end of a sluice box submerges and mixes below the water surface. This turbulent action breaks the surface tension and the dense materials settle out in a short distance.

January 2010, EPA reported that "since suction dredge mining creates turbidity in the stream it is likely this action increases oxygenation of the waters and therefore, methylation of inorganic mercury would be less likely to occur in these habitats." No quantitative evidence is presented concerning the degree of oxygenation, or whether it has any appreciable effect on general, downstream levels relevant to methylation processes. Determinations of significance require more than theorizing as to possible effects.

As one would expect the results of the USGS study (Fleck 2011) using the 3-inch dredge showed only a slight increase in particulate total mercury present in the water column immediately downstream of the suction dredge. Data indicating that an increase of particulate total mercury does not equate to an increased concentration or change in speciation to the more toxic form methylmercury.

It is important in dealing with science to occasionally step back and ask yourself 'So what?' It's necessary as a scientist to not try to push the data and your resulting conclusion into a pre-conceived notion of what your initial theory was. The push to smear suction dredging with the presented information raises the question of whether we are dealing with scientists or activists working for the USGS. Let me quickly show you what a dredge study should look like.

In the following illustration, from the Fortymile River study in Alaska, you can see the dredge location in the river. There are two control sampling sites upstream of the dredge and several transects with multiple sites crossing the entire river. That is a true example of scientists performing high quality, subject specific research.

In the presentation to the CDFG PAC Claudia shared numerous peer-reviewed journal articles that prove selenium's chemical antagonism to mercury, and other mercury species such as methylmercury, cause no significant harm to fish or human health. These published peer reviewed articles leave no doubt that toxicity from mercury contamination in historic mining basins is (Less than Significant).

There is no doubt that methylmercury may cause harm under the right circumstances. An example of this occurred in Minimata, Japan where inhabitants were exposed to 27 tons of mercury waste dumped in the bay but, with no corresponding shift in selenium levels. However, there has been a large body of (peer reviewed) evidence published that demonstrates that supplemental dietary selenium moderates or counteracts mercury toxicity. Mercury exposures that might otherwise produce toxic effects are counteracted by selenium, particularly when the Se:Hg molar ratios approach or exceed 1." Selenium has a high affinity to bind with mercury thereby blocking it from binding to other substances, such as brain tissue. The bond formed is irreversible. "All higher animal life forms require selenium-dependent enzymes to protect their brains against oxidative damage (Peterson 2009)". As early as 1967 Parizeik found that high exposures Se and Hg can each be individually toxic, but evidence supports the observations that co-occurring Se and Hg antagonistically reduce each other's toxic effects.

In 1978, scientists from Sweden were reporting that "mercury is accompanied by selenium in all investigated species of mammals, birds, and fish," adding that it "seems likely that selenium will exert its protective action against mercury toxicity in the marine environment" (Beijer 1978). Building onto the list of species known to be protected by selenium's bond with mercury and the toxic effects of methylmercury, a group of Greenland scientists in 2000, published the results of mercury and selenium tests performed on the muscles and organs of healthy fish, shellfish, birds, seals, whales, and polar bears. They found that, "selenium was present in a substantial surplus compared to mercury in all animal groups and tissues" (Dietz 2000)

Not only ocean species but freshwater species are found to also be protected. Researchers at Laurentian University in Ontario, Canada reported that selenium deposits, from metal smelters into lake water, greatly decreased the absorption of mercury by microorganisms, insects, and small fish. Suggesting a strong antagonistic effect of selenium on mercury assimilation (Yu-Wei 2001). Peterson's group (2009) collected 468 fish representing 40 species from 130 sites across 12 western states. Samples were analyzed for whole body selenium and mercury concentrations. The fish samples were evaluated relative to a wildlife protective mercury threshold of 0.1 ug Hg/g wet weight, and the current tissue based methylmercury water quality criteria for the protection of humans of 0.3 ug Hg/g wet weight and presumed protective against mercury toxicity where the Se:Hg molar ratios are greater than 1. The study included data from samples collected in California which, in all cases, contained proportions of mercury to selenium that were adequate to protect fish, wildlife and human health. Results showed 97.5% of the freshwater fish in the survey had sufficient selenium to protect them and their consumers against mercury toxicity. The California results were 100% protective.

Ralston's research (2005) supports Peterson's (2009) findings stating that "Mercury toxicity only occurs in populations exposed to foods containing disproportionate quantities of mercury relative to selenium." Also supporting this finding inadvertently, the California Office of Environmental Health Hazard Assessment website has no evidence of any one in California that has died from mercury poisoning from eating sports fish... despite mercury warnings they have issued.

"Methylmercury exposure to wildlife, and to humans through fish consumption, has driven the concern for aquatic mercury toxicity. However, the methylmercury present in fish tissue might not be as toxic as has been feared. Recent structural analysis determined that fish tissue methylmercury most closely resembles methylmercury cysteine (MeHg[Cys]) (or chemically related species) which contains linear two-coordinate mercury with methyl and cysteine sulfur donors. MeHg[Cys] is far less toxic to organisms than the methylmercury chloride (MeHgCl) that is commonly used in mercury toxicity studies." (Harris 2003).

The best science suggests that the tiny amounts of mercury in fish aren't harmful at all. A recent twelve-year study conducted in the Seychelles Islands (in the Indian Ocean) found no negative health effects from dietary exposure to mercury through heavy fish consumption. On average, people in the Seychelles Islands eat between 12 and 14 fish meals every week, and the mercury levels measured from the island natives are approximately ten times higher than those measured in the United States. Yet none of the studied Seychelles natives suffered any ill effects from mercury in fish, and they received the significant health benefits of fish consumption

Forty years of research illustrates the conclusion, from hundreds of journal articles, that demonstrate mercury is not a threat to the environment or human health if the molar ratio of selenium:mercury meets the defined criteria. In California there are adequate supplies of selenium to support the criteria. Results of these studies support the fact that methylmercury is not deleterious to fish and wildlife or aquatic organisms.

We disagree with the Significant and unavoidable conclusion, because of the lack of factual scientific basis that would support this conclusion. We would recommend that it be changed from Significant and unavoidable to (Less than Significant) until the full body of science is
evaluated.

Impact CUM-7. Cumulative Impacts of Mercury Resuspension and Discharge from Suction Dredging (Significant and Unavoidable)

Cumulative Impacts are no different in this regard as Impact WQ-4. The many factors associated with bioavailability such as total hardness, dissolved organic carbon, pH, alkalinity, sulfate reducing bacteria, anaerobic conditions, etc. need to be present for methylation and bioaccumulation in the food chain. Even if the conditions for methylation are met, if selenium to mercury has, at least, a 1:1 molar ratio all the mercury will bind with selenium creating an irreversible bond cancelling any potential toxic effects of mercury. Furthermore, since this opinion appears to rely heavily on the purported "scientific" results provided by the USGS dredge study they are totally worthless and should not be used for the aforementioned reasons.

We disagree with the Significant and unavoidable conclusion, because of the lack of factual scientific basis that would support this conclusion. We would recommend that it be changed from Significant and unavoidable to (Less than Significant) until the full body of science is
studied.

Sincerely,

Claudia J, Wise

Physical Scientist, U.S. Environmental Protection Agency [RETIRED]

and

Joseph C, Greene

Research Biologist, U.S. Environmental Protection Agency [RETIRED]

REFERENCES

Alpers, C.N.; M.P. Hunerlach; M.C. Marvin-DiPasquale; R.C. Antweiler; B.K. Lasorsa; J.F. DeWild; and N.P. Snyder. 2006. Geochemical data for mercury, methylmercury, and otherconstituents in sediments from Englebright Lake, California, 2002. USGS Data Series 151, 95p.

Beijer, K., A. Jernelov (1978). "Ecological aspects of mercury--selenium interactions in the marine environment." Environ Health Perspect 25:43-5.

Curtis, J.A.; L.E. Flint; C.N. Alpers; S.A. Wright; and N.P. Snyder. 2006. Use of sediment rating curves and optical backscatter data to characterize sediment transport in the upper Yuba River Watershed, California, 200103. USGS Scientific Investigations Report 2005-5246, 74 p.

Dietz, R. , F. Riget and E. W. Born. An assessment of selenium to mercury in Greenland marine animals. The Science of The Total Environment. Volume 245, Issues 1-3, 17 January 2000, Pages 15-24

Fleck, J.A.., Alpers, C.N., Marvin-DiPasquale, M., Hothem, R.L., Wright, S.A.,

Ellett, K., Beaulieu, E., Agee, J.L., Kakouros, E., Kieu, L.H., Eberl, D.D., Blum, A.E., and May, J.T., 2011, The effects of sediment and mercury mobilization in the South Yuba River and Humbug Creek Confluence Area,, Nevada County, California: Concentrations, speciation, and environmental fate—Part 1: Field characterization: U.S. Geological Survey Open-File Report, 2010-1325A, 104 p.
Harris HH, Pickering IJ, George GN. 2003. The chemical form of mercury in fish. Science 301:1203.
Humphreys, R. 2005. Mercury Losses and Recovery, During a Suction Dredge Test in the South Fork of the American River. In House Report, California Water Board.
Marvin-DiPasquale, M. , et.al,. 2009. Presented at the 19th Annual Meeting of the Northern California Regional Chapter of the Society of Environmental Potential impact of disturbance events on mercury associated with hydraulic mining sediments.
Nishigak, S. and Harada, M. 1975. Methylmercury and selenium in umbilical cords of inhabitants of the Minamata area. Nature 258, 324 - 325
Parizek et al. "The protective effect of small amounts of selenite in sublimate intoxication." Experientia. 1967 Feb 15;23(2):142-3.
Peterson, S. A. et al, 2009, How Might Selenium Moderate the Toxic Effects of Mercury in Stream Fish of the Western U.S.?, Environmental Science and Technology., 3919–3925
Ralston, N. Physiological and Environmental Importance of Mercury-Selenium Interactions. United States Environmental Protection Agency National Forum on Contaminants in Fish. September 19, 2005.
Royer, T. V., A. M. Prussian and G. W. Minshall. 1999. Impact of suction dredging on water quality, benthic habitat, and biota in the Fortymile River and Resurrection Creek, Alaska. Final Report. For the U. S. Environmental Protection Agency, Region 10, Seattle, WA. 72pp.

SUSUMU NISHIGAKI* & MASAZUMI HARADA. 1975. Methylmercury and selenium in umbilical cords of inhabitants of the Minamata area. Nature 258, 324 - 325
US EPA, 2010, Biological Evaluation for Small Placer Miners in Idaho National Pollutant Discharge Elimination System (NPDES) General Permit, U.S. Environmental Protection Agency, Region 10, Seattle, Washington.
Yu-Wei Chen, N. Belzile and J. Gunn. Antagonistic effect of selenium on mercury assimilation by fish populations near Sudbury metal smelters? Limnology and Oceanography. 2001;46(7):1814-1818.

Letter by Claudia Wise retired EPA chemist
(dcc: D Fi M)
From here: http://www.icmj.com/UserFiles/file/recent-news/Claudia%20Wise%20on%20SB%20670.pdf

The Honorable Governor Arnold Schwarzenegger
State Capitol Building Sacramento, CA 95814
Fax: 916-558-3160
Dear Governor Schwarzenegger,

PLEASE VETO BILL SB670 (anti-suction dredging legislation)

My name is Claudia Wise; I retired in 2006 after 32 years of civil service with the U.S.EPA as a physical scientist/chemist. I have been a member of many scientific projects over the years starting my federal career in the Fish Toxicology arena and ending it with the Salmon Restoration division. I have worked on projects ranging from urban fish populations and fish avoidance testing to eelgrass habitat and global climate change. I have been and remain to be a strong proponent of protecting the environment.

On October 11, 2007 in regards to AB 1032 I wrote to you regarding another attempt by the legislature to get around a court order and unnecessarily put a large group of miners and businesses out of work with no scientific evidence to support their claims.

Dozens of peer-reviewed journal articles some commissioned by the USEPA, USGS, CDFG, Corp of Engineers, and many more from universities support suction dredging as having *de minimis* effects or no significant effect on the environment they are used in. Nothing has changed in peer-reviewed literature since that time to change this fact.

Suction dredge mining has little impact on the areas fish and biota. In relation to natural occurrences suction dredge mining is insignificant. To put the impact of suction dredge mining into perspective it was calculated that suction dredge mining disturbs only 0.7% of the sediment that is moved naturally in a year. The Siskiyou National Forest (SNF), where this study occurred, is a very prominent mining area in California.

According to the U. S. Forest Service, SNF, "There are 1,092,302 acres on the Siskiyou Natural Forest. Using a factor of 0.33 cubic yards per acre per year times 1,092,302 acres will produce a very conservative estimate that 331,000 cubic yards of material move each year from natural causes compared to the 2413 cubic yards that was moved by suction dredge mining operations in 1995. This would be a movement rate by suction dredge mining that equals about 0.7% of natural rates." (Cooley 1995).

California Department of Fish and Game already regulates the miners out of the waterways during important life events for the Salmon. That includes during spawning season when redds are present.

It is well known that suction dredging causes little or no environmental harm to fish and biota what many overlook are the many benefits that dredging provides such as increased spawning gravels, dredge made refugia, and yes, mercury remediation to name a few.

Suction dredging breaks up cemented riverbeds providing fish with loose gravel for future spawning grounds in areas fish presently are not able to use for spawning. Between 1996 and 1998, Quihillalt (1999) found 4% of redds where located on or within 1000 m of dredge tailings. He theorized that dredge tailings may be attractive sites for redd construction because tailings are often located near riffle crests where fish frequently spawn, and they provide loose, appropriately sized substrate. However, embryos in tailings may suffer high mortality during years of high river flows (1998) and be of no concern during years of low river flows (1996 & 1997).

During a later survey on the Klamath River during 2002 only one redd was observed on suction dredge tailings. Recreational suction dredge mining was present throughout the survey from the Highway I-5 Bridge to Happy Camp (Schuyler and Magneson. 2006).
Even with scouring effects to redds reported in scientific literature this gravel provides areas to spawn that would not otherwise be available to them. Any added benefit to increasing salmon productivity, using suction dredging, is a benefit to fish numbers. Even during years of high mortality due to high flow events if only a few of the embryos survive that may be more than would be expected without the benefit of added spawning gravels provide by the tailings.

I have been involved in temperature surveys on the Klamath River in California in regards to suction dredge activity and existing conditions of refugia. We have found natural refugia to be no better in many cases to that of dredge made refugia.

Dredge holes can provide a holding place for fish as they pass up the waterway on their migration path to and from the ocean providing a place to get out of the faster currents to rest. Some of these dredge holes may also be cooler due to ground water seepage if the holes are deep enough. This leads to development of additional areas of needed refugia.
Another Benefit the suction dredge community could provide the state with is mercury remediation. In talking with miners, the majority typically do not run into large pools or hot spots of mercury. However, their concerned for the environment is the same as other citizens. Miners have shown the willingness to hand over collected mercury to a collection facility if such a facility exists. The California State Water Board's Water Quality Division report (Humphreys, 2005) suggested the idea of paying the miner's for their efforts would help facilitate this plan. Collection facilities have been provided in the past with great response.
The California Water Board has spent a lot of time and money on mercury remediation projects with limited success, though in 2001 EPA Region 9 located in San Francisco, California did collect mercury from miners very effectively. Collections of mercury has been happening in Oregon and Washington through the states respective Division's of Ecology and with even greater success at miner's rallies.

Even though EPA Region 9 has ended this program and removed it's existence from the website EPA, Region 9 had a mercury "milk run" in 2000. Agency personnel were able to collect 230 pounds of mercury from miners and local dentists. The total amount of mercury collected was equivalent to the mercury load in 47 years worth of wastewater discharge from the city of Sacramento's sewage treatment plant or the mercury in a million mercury thermometers. (US EPA, 2001.)

Over the past four years, the Resources Coalition and other small-scale miners associations in Washington have turned in 127 pounds of mercury and eight pounds of lead for safe disposal with the help from the Washington Department of Ecology. Ecology staff attended miners' rallies in Oroville and Monroe, explaining the state's program for proper disposal of lead and mercury. (ENS 2007).

The mining community of today is, in my opinion, the only group that is in a position with the technology to help with the removal of lead and mercury at a very economical price to the public. Any residual mercury remaining after dredging is that much less to worry about residing in our Nations waterways.

In reviewing Humphrey's (2005) comments regarding possible problems associated with collecting mercury via suction dredging methods, it is right to look to the suction dredge community for help locating hotspots and removing mercury from the river systems. In my opinion the data provided in the report by Humphrey's (2005) did not demonstrate any clear conclusions that would prohibit the State from allowing this activity. On the contrary, in the discussion of results it was stated that a suction dredge in the American River was able to collect 98 percent of the measured mercury processed through the dredge. The amount of mercury collected may have been higher if the investigators had been using a dredge with the modern jet flare design. Even 98 percent is a huge plus for the environment and it would be irresponsible to not allow mercury to be removed from the rivers and streams whenever it is found.

In Humphreys report (2005), the author expressed concern for the loss of a small portion (2%) of the mercury from the back end of the sluice box. In the conclusions it was stated that the amount lost constituted a concentration more than ten times higher than that needed to classify it as hazardous waste. Yet 98 percent of the mercury was now secured and the process did not add any mercury to the system that was not already present. The small fraction lost, because of its density, would relocate back onto the river floor buried in the sediment close to where it was removed while dredging.

Mercury is continuously moved every winter in high storm events. Since the cessation of hydraulic mining, accumulated sediment from hydraulic placer mining has been transported to the Sacramento–San Joaquin Delta and San Francisco Bay by sustained remobilization (James, 1991). Providing a program to collect mercury from miners would aid the Water Board's mission of reducing mercury contamination in the deltas and bays where mercury methylation is a large concern.

In the test described by Humphreys (2005) a small portion of floured mercury was collected in the sediments as it escaped the sluice box. This mercury whether floured before it entered the sluice box, or not, would still be in elemental form. Regardless of surface area it would be no more toxic then the other 98 percent that was suggested to be left in place.
Aside from grossly polluted environments, mercury is normally a problem only where the rate of natural formation of methyl mercury from inorganic mercury is greater than the reverse reaction. Methyl mercury is the only form of mercury that accumulates appreciably in macroinvertebrates and fish. Environments that are known to favor the production of methyl mercury include certain types of wetlands, dilute low-pH lakes in the Northeast and North central United States, parts of the Florida Everglades, newly flooded reservoirs, and coastal wetlands, particularly along the Gulf of Mexico, Atlantic Ocean, and San Francisco Bay (USGS 2000).

If not collected the mercury is guaranteed to end up farther down stream, and eventually in the delta or the bay, where methylation is a real environmental problem. In my opinion it would be a highly irresponsible management practice to leave a large portion of mercury in the rivers and streams because of unrealistic concerns for the lesser amount moving only a short distance away from an operating dredge. Most likely if floured the movement of fine mercury would extend no farther than 50-feet off the end of the sluice box. That would relate to the distance a turbidity plume might extend downstream from a small-scale suction dredge.
However, if the mercury was left in place the next storm event would surely move it downstream closer to, and eventually into, the bay and delta. In fact, according to Humphrey's study in 2005 mercury was seen moving down stream and re-deposited on bedrock already dredge cleaned. The important fact here is mercury was flowing down stream in a suction dredge free zone during lower river flows than what take place under high winter river conditions.

It is most important to reduce the total amount of mercury in the streams and rivers and its transport downstream into the bays and deltas. This is defined as a part of Total Maximum Daily Load ("TMDL") goals.

We know for certain that mercury is transported downstream throughout the winter season during high water events. Therefore, anytime there is the possibility for the removal of mercury by miners it should be undertaken and supported.

You justifiably vetoed that last bill because it was unnecessary and suction dredge mining is already regulated by the Department of Fish and Game. But here we are again….
There was no reason, last year, to sign AB1032 into law and there is no reason to sign Bill 670 into law this year. I respectfully ask that you not add further to the problems related to increased government regulation where none is warranted. Please allow

California Fish and Game to do their job. They are already regulating suction dredging adequately to protect fish. The court has ordered California Department of Fish and Game to prove suction dredging creates significant harm before changing the mining regulations.

I respectfully ask that you VETO bill 670.

Sincerely,
Claudia Wise
34519 Riverside Dr SW
Albany, Oregon 97321
541-990-7009

REFERENCES

Cooley, 1995, USFS. Siskiyou National Forest Service Yardage Estimate, **A comparison of stream materials moved by mining suction dredge operations to the natural sediment yield rates.** In house Report.
Environment News Service (ENS). 2007. **Miners Remove Gold Rush Mercury from Washington Streams.**
http://www.ens-newswire.com/ens/sep2007/2007-09-18-096.asp
Grove, Schuyler and M. Magneson. 2006. USFWS. Arcata Fish and Wildlife Office, **Mainstem Klamath River Fall Chinook Salmon Spawning Survey.**
Humphreys, R., 2005, **Losses and Recovery During a Suction Dredge Test in the South Fork of the American River.** Staff Report, State Water Resources Control Board, Division of Water Quality.
James, A.L., 1991**, Incision and morphologic evolution of an alluvial channel recovering from hydraulic mining sediment**: Geological Society of America Bulletin, v. 103, p. 723–736.
Quihillalt, Rick R and J. D. Glase., 1999. USFWS. Arcata Fish and Wildlife Office, **Mainstem Trinity River Fall Chinook Salmon Spawning Redd Survey, 1996 through 1998.** In house Report.
USEPA, 2001. **Mercury Recovery from Recreational Gold Miners.**
http://www.epa.gov/region09/cross_pr/innovations/merrec.html
USGS, 2000. Mercury in the Environment, USGS Fact Sheet 146-00 (October 2000)
Environments Where Methyl mercury is a Problem.

Having reviewed all 897 pages of the above Report and countless other related documents, a lot of time and taxpayer money was spent trying to educate the public and DFG personnel about mining and more specifically about "suction dredging." Education is never a waste but in this case it may have been. It is apparent from the conclusions cited as "Significant and Unavoidable Environmental Impacts" that analysis of the collected data has been twisted in places into what appears to be self-serving and bias findings. Throughout the Report, there were premature assumptions and faulty analysis of alleged problems because the real answer was not known or the available data would not support the desired conclusion. In such instances, the problem was simply declared "significant and unavoidable." Despite all these pitfalls, surprisingly, there were parts of the Report itself that make a good argument for why more restrictive dredging regulations were NOT justified. Beginning with the very first paragraph of Section 228 of the DFG proposed regulations related to suction dredging, it states in part, "... ***the Department finds that suction dredging...will not be deleterious to fish.*** **" Notwithstanding that published conclusion, the DFG proceeds to propose implementation of a prolonged and tedious number of changes affecting the manner in which suction dredging is performed. Even more disconcerting to the financial interest of claims owners, the proposed restrictions on dredging contained in the DSEIR take away "property rights" granted by the Mineral Estate Trust Act of 1866 and the Mining Law of 1872. The taking of such rights is a blatant violation of due process guaranteed by the 5th amendment as it applies to the Federal Government and to the 14th amendment as it applies to states. The taking of "property" without just cause or compensation is illegal and will**

L228-5

continue to be pursued in lawsuits filed by the Public Lands for the Public and this litigation will continue to be pressed forward regardless of the outcome of these proposed new regulations. Notwithstanding the violations and legal entanglements referenced above, let us address the alleged "Significant and Unavoidable Impacts" referenced in Chapter 6.2.3 of the DSEIR:

*These are also listed on the Executive Summary Table ES-2

Impact WQ-4: Effects of Mercury Resuspension and Discharge from Suction Dredging: This impact details analysis of Hg (Mercury) discharge and transport resulting from both dredging operations and watershed sources such as rainfall and runoff. Nobody disputes that there is mercury present in historic gold mining areas as a result of earlier gold mining efforts. But, as the report indicates, this mercury continues to slough into the river without regard to dredging activity. The report clearly points out on Page 4.2-38 that, "… ***In contrast to Hg discharged from suction dredging; the majority of HG is from background watershed sources during the winter wet season, when runoff conditions contribute to high flows that scour sediments laden with Hg."*** **Yes, every winter Mother Nature creates a "significant disturbance" and dredges without a permit. The report further cites a series of mercury samples that were taken once a month in the summer while preparing this Report. The conclusion at the bottom of Page 4.2-38 was that, "…*it is possible that suction dredges were contributing to the annual HG load calculated, but Hg levels do not appear to reflect unusually high concentrations during the dry season. Given this, there are inherent uncertainties to the Hg loading estimates."* The Report itself stipulates that there are uncertainties as to the cause of HG loading that is present. So, the conclusion stated clearly in the report is that nobody knows anything for sure**

about movement of HG in streambeds. Even more indicative of this conclusion, on Page 4.2-40 it is reported that HG particles less than 63 um, *"...do not remain suspended during summer low flows and are thus deposited back into the river."* This conclusion is no surprise to dredgers. Even further, on Page 4.2-41 it is finally concluded that, *"Transport of elemental Hg that is floured and discharged from suction dredging is largely unknown as floured HG has been observed to float initially but subsequently sink or float until they are dissolved."* Yes, what goes up must come down and nobody knows how much mercury is discharged by suction dredging but the report makes clear that Mother Nature is the biggest contributor. The report also defines the low flow, summer months of dredging as between March and October. Therefore, the question presents itself as to why the proposed regulations are striving to cut short the dredging season for most dredgers to three months between July and September? WQ-4 is unfounded and should be corrected to read a finding of "less than significant."

<u>Impact WQ-5: Effects of Resuspension and Discharge of Other Trace Minerals from Suction Dredging</u>: This area details results to determine the impact of other sediments encountered when dredging such as copper, lead, zinc, etc. Again, the conclusions on Page 4.2-58/59 are that dredging has a *"negative impact."* It is reported that suction dredging would not be expected to increase levels of trace minerals nor result in substantial, long-term degradation of trace metal conditions that would cause adverse effects. Finally, it is further reported that the potential to mobilize the trace metals would not substantially increase health risks to wildlife. Everything sounds good for dredgers so far. However, then the report begins to speculate. It reaches out in desperation to

suggest that, *"If"* dredging at known metal hot spots actually contained acid mine issues, low pH levels, high sediment, and pore metal concentrations, there *"may be"* a potentially significant impact. There are too many "ifs" and "maybes" in that assumption. Yet, despite the lack of data or knowledge to accurately identify where such conditions might exist, the report suggests that the "unknown" itself presents a significant and unavoidable impact. This is pointless analysis at its worst. The conclusion imagines that the perfect storm of conditions might exist out there somewhere to affect trace mineral conditions. That's like saying, "Somewhere in those mountains, there is gold." Impact WQ-5 is unfounded and should be corrected to read a finding of "less than significant."

Impact <u>BIO-WILD-2: Effects on Special-Status Passerines Associated with Riparian Habitat</u>: This impact details the results to determine whether dredging impacts special-status passerine species by altering behavior, movements, and distributions. Passerines were defined as birds that are adapted for perching. This means that they primarily live in the trees. The specific disturbance of reported concern is noise from dredge equipment or encampment activities. This whole discussion is prejudicial against miners without a scintilla of scientific proof to back it up. Further, the report totally ignored any discussion or consideration for the level of noise generated by hunters, fishermen, campers, hikers, recreational vehicles, and other outdoor activities. On a scale of noise makers, suction dredgers have to be far and away the minority in number and create the least impact on the environment. This whole argument is a stretch and complete over-reaching by the Report writers. The report attempts to support its weak position by stating that, "even a

small disturbance could be substantial." Where is the scientific data for that conclusion? These are passerine creatures that live in the outdoors and expect noise as well as other disturbances all the time and on a wide range of levels. In addition, on Page 4.3-49 of the report, it suggests an accurate determination of any potential impacts to these special-status passerines must be studied using field surveys by qualified biologist to determine their location using the California Natural Diversity Database (CNDDB) and other such sources. So, the report is really stating that nobody knows where these alleged passerines live. Well, if the locations of these passerines are important, DFG needs to submit a proposal for funding of research by qualified biologists to pinpoint locations and see what kind of funding support is present. Impact BIO-WILD-2 is unfounded and should be corrected to read a finding of "less than significant."

Impact CUL-1: Substantial Adverse Changes, When Considered Statewide, in the Significance of Historical Resources: This impact was to consider how dredging might affect historical and cultural resources. This is yet another example of when we don't really know anything, let's just assert that dredging is the cause. How do we know this to be true? On Page 4.5-12, it discusses the potential impact of dredging on historical resources. The Report states, "*...Whether this impact would have a substantial adverse change in the significance of a resource when considered statewide is a function of the likelihood of disturbance of these resources and their individual and/or collective significance. It is unknown whether suction dredge mining would affect significant historical resources to a level that would be considered significant statewide.*" In other words, such impact cannot be attributed to dredging. Yet nonetheless, again, the writers of this Report use the same old crutch as used

previously and conclude that since an impact cannot supported by scientific data, it will simply be labeled a "potentially significant impact" attributable to dredging. But, further on Page 4.5-13, the report also confesses that the only way to know for sure about the location of any historical resources would be to conduct archival research using the California Historical Resources Information System (CHRIS). Well, by all means, let the DFG propose a research team be assembled to conduct this perceived vital research and send it along the aforementioned study on passerines. Clearly, this whole issue is again over zealous staffers trying to make reach a preconceived conclusion when no data exists to support it. Impact CUL-1 is unfounded and should be corrected to read a finding of "less than significant."

Impact CUL-2: Substantial Adverse Changes, When Considered Statewide, in the Significance of Unique Archaeological Resources: This impact was to consider how dredging might affect archaeological resources listed in the California Register of Historical Resources (CRHR). This is another case as detailed previously where CFG has put the "cart in front of the horse." What impact and where are these archaeological resource sites? Well, again, the report clearly describes that nobody knows. Beginning on Page 4.5-14, the Report states, "*...Whether this impact would have a substantial adverse change in the significance of a unique archaeological resource when considered statewide is a function of the likelihood of disturbance to such a resource and its individual and/or collective significance. It is unknown whether suction dredge mining would affect unique archaeological resources to a level that would be considered significant statewide.*" The report goes on further to suggest that the only way to know if there are unique archaeological

sites, one would need to perform archival research using the California Historical Resources Information System (CHRIS). Well, this sounds like another budget proposal that DFG would need to submit for fundins. The fact is that if this allegation were true and verifiable, the DFG or some environmental group would have already performed this research and published the information. Impact CUL-2 is unfounded and should be corrected to read a finding of "less than significant."

<u>Impact NZ-1: Exposure of the Public to Noise Levels in Excess of City or County Standards</u>: This impact considers whether operating dredge equipment exceeds noise standards. If this entire study were not so serious in its potential impact to miners, this particular impact would be laughable for lack of support and scientific merit. First of all, where are the noise level standards that apply to conditions, equipment, and animals found in Mother Nature? Does a mountain lion, wolf, or moose violate this unknown standard when they sound a mating call? The fact is that this particular impact is another "pie in the sky" effort to dream up problems and blame the problem on dredging. However, again, the Report tells us what we need to know. The report states that while dredging has the potential to generate excess noise, the existing regulations do not authorize permit holders to use their equipment in a manner that violates existing noise standards. Further, on Page 4.7-9, the Report states, "*...all recreationist... are equally required to abide by local noise ordinances. Violations can be reported at any time to local authorities who have the jurisdiction to enforce applicable regulations as appropriate.*" Nonetheless, absent any concrete data to support that dredgers violate recognized noise standards, the writers of this report use the same approach as in other situations where they lack scientific

data. The Report writers declare the impact to be "significant and unavoidable" out of nothingness. This is a outrageous conclusion and unfounded. Consequently, Impact NZ-1 should be corrected to read a finding of "less than significant."

<u>Impact CUM-2: Effects on Wildlife Species and Their Habitats</u>: This impact considers the extent dredging operations could have on non-riverine aquatic invertebrates, reptiles, birds, and mammals. Amazingly, the Report finds that dredging does not have any considerable cumulative impact on any of these creatures and declares a finding of "less than significant" in these cases. However, in the case of several bird species, the report expresses a concern with the so called "incremental effects" of the proposed program. This is puzzling since on Page 5-23 of the report, it states that, *"Similar to fish species, declines in non-Fish species populations are largely due to long-term degradation of environmental conditions. With few exceptions, the declines in the population of a non-fish species are the result of the synergistic effects of anthropogenic activities, and not a single causative agent or project."* The word "anthropogenic" means "caused by humans." So the Report is already saying that it's not "dredging" *per se* that impacts non-fish or bird species but a lot of "unknown" human factors. The Report acknowledges that there are other influencing factors besides dredgers affecting the environment. And, let's not forget that "dredgers" are in the water and birds are in the trees. Yet, this report contends that out of all the other thousands of bird, plant, and non-fish species discussed in the report, the eight non-fish species listed on Table 4.3-3 are in danger to dredging operations. This is like pulling out the mythical "needle from the haystack." It is the position of miners that these eight species are no

less impacted or at risk than the hundreds of other species determined in the Report to be "less than significant." This impact is not based upon any scientific proof but mere conjecture. Consequently, impact CUM-2 is unfounded and should be corrected to read "less than significant."

Impact CUM-6: Turbidity/TSS Discharge from Suction Dredging: This impact considers alleged turbidity impairments from dredge discharges impacting fish. It is a shame that the writers of this report have not actually dredged themselves or they would know firsthand the ridiculous nature of this argument. Fish surround dredgers when they are dredging because they know that food is on the menu again. Yet the false premise that turbidity from dredge discharges hurt fish has spawned into an argument for closing or restricting dredging operations. Reference is made again to the Report itself in Section 228 of the DFG Proposed Amendments to the Regulations related to suction dredging where it makes the bold statement that, "*...the Department finds that suction dredging...will not be deleterious to fish.*" Further on Page 5-28, the Report references past, present, and future turbidity sources of turbidity which include: agriculture, aquaculture, effluent pollution, recreation, urbanization, timber harvest, and wildfire, fire suppression, and fuels management. In essence, the Total Maximum Daily Load (TMDL) of turbidity touted in the Report has many causes and the least of which is from dredging. This impact is overstated and embellished to serve its masters rather than speak the truth. Impact CUM-3 is unfounded and should be corrected to read "less than significant."

Impact CUM-7: Cumulative Impacts of Mercury Resuspension and Discharge from Suction Dredging: This impact considers how dredging affects existing concentrations of Mercury present

in the sediments of historic gold-mining and gold bearing regions. There is no getting around that Mercury was left behind by historic miners and mining operations. However, as previously discussed under in Impact WQ-4 and detailed on Page 4.2-8 of this Report, *"the transport of elemental Hg that is floured and discharged from suction dredging is largely unknown but floured HG floats initially and will subsequently sink or float until they are dissolved."* Now the Report suddenly mentions a new mysterious field study conducted by USGS scientists in the Yuba River system. First, who are these alleged "scientists and Hg experts" and what are their qualifications? Quite candidly, this new field study just seems too obvious and convenient. It is also too premature to be accepted as reliable data. On Page 4.2-19 of this Report, it clearly states that the information provided by these unknown experts was *"preliminary results."* In other words, this study (if it is one) has not undergone any peer review or been validated. And validation is necessary since the USGS chose a location where Humbug Creek meets the confluence of the South Yuba River. This is a prejudicial site for any representative field test since this is the location of the Malakoff Diggins where heavy hydraulic mining occurred and is not likely to result in data that can be repeated in other field research. Point in fact, on Page 4.2-23 of the Report, it states, "… *The South Yuba river watershed experienced the most intensive level of hydraulic mining, in which mercury-contaminated hydraulic mining debris was produced, and discharged in the watershed.* Reasonably, this is not a scientifically representative location from which to extrapolate a conclusion about effects of mercury Resuspension. This explains why on Page 4.2-54 of the Report, it concludes, *"…because not all locations of elemental mercury deposits are known, the feasibility with which sites containing mercury*

could be identified at a level of certainty that is sufficient to develop appropriate closure areas or other restrictions for allowable dredging activities, is uncertain at this time." **Further on the same page, the Report states, *"…a comprehensive set of actions to mitigate the potential impact through avoidance or minimization of mercury discharges has not been determined at this time, nor is its likely effectiveness known."*** **So, we don't know exactly where all this mercury resides and, even if we did, the effectiveness of trying to mitigate impact is unlikely. And finally, on Page 4.2-36 of the Report, it states, *"…modern equipment may result in less flouring"*** **when discussing the impact of mercury. So, the data used to support this impact is based upon inconclusive field results and the whole problem itself may be admittedly an insolvable one. But we do know that material disturbed in any waterway will find its way to the bottom and Mother Nature does more to disrupt Mercury sediments that any dredger ever could. Impact CUM-7 is unfounded and should be corrected to read "less than significant."**

Somewhere between the "1994 Regulations Alternative" and the "Reduced Intensity Alternative" there exists an alternative that would allow CFG to continue to do its job as well as allow miners greater access their claims. But, only data that can be scientifically supported should be considered. Meanwhile, dredging should not be restricted or prohibited in those areas and during those times of the year when dredging would not pose problem to the environment. All miners are open to some better dredging practices but dredgers should not be scapegoats.

Posted by Patrick Keene at 5:43 PM 0 comments

Assessing risk on a site-specific basis across the state would be possible following site-specific characterization of: 1) sediment Hg levels, 2) estimates of watershed load, 3) impact on methylation experiments, and 4) impact on reactivity of resuspension experiments. Suction dredging will likely not pose substantial risk at every location it is practiced, but substantially increased risk from dredging discharges and associated Hg resuspension will likely be common across the state.

Summary of Findings

Suction dredging operators may target deep sediments (i.e., those too deep to be available to scour under winter flows), and thus mobilize sediment that may not be mobilized by typical winter high-flow events. Sediments in the historic gold-bearing and gold-mining areas of California that would be targeted by suction dredgers also may be elevated in Hg compared to sediments in other non-mining areas. The discharge of sediment with high THg concentrations will result in increased THg concentrations in upper sediments of downstream water bodies, particularly in lower elevation zones of natural sediment deposition (e.g., low-gradient floodplains), including reservoirs where present. A substantial fraction of the fine sediment also may pass through lower elevation reservoirs and thus be transported to lower elevation locations, such as the Sacramento-San Joaquin Delta, where Hg methylation and uptake may occur.

The fate and transport assessment conducted herein, based on recent intensive field studies of sites in the Yuba River system conducted by USGS scientists, indicates that the discharge and transport of THg loads from suction dredging of areas containing sediments highly elevated in Hg and elemental Hg is substantial relative to background watershed loadings, especially in below average runoff water years. For example, within areas of highly elevated sediment Hg concentrations, a single suction dredge operator using an average size (4 inch) dredge could discharge approximately 10% of the entire watershed Hg loading during a dry year during an average suction dredging time of 160 hours. By inference, the analysis indicates that larger capacity dredges or multiple dredges operating in similar sediments with highly elevated sediment Hg concentrations could potentially contribute a much larger proportion of the watershed load than 10%. The value 10% was selected based on a professional judgment of what would be a measurable increase in background loading. The analysis does not assume that this is a threshold of significance below which effects are insubstantial, but is used as a reasonable point of reference. The relative proportion of THg loading from suction dredging activity, compared to background watershed loading, is directly dependent on the dredge size, duration of operations during the year, and sediment characteristics and concentrations. The loading assessment indicates that dredging in areas with average sediment Hg concentrations and no elemental Hg is unlikely to result in a substantial contribution to the overall watershed loading. For example, when dredging in sediments with average Hg concentrations, more than the entire permitted population of suction dredgers would need to be operating within the watershed to discharge 10% of the background Hg loading in a dry year using average size (4 inch) dredges. Additionally, suction dredging discharge and transport of THg occurs primarily in the summer rather than the winter, when most background Hg is transported to reservoirs. While the precise implications of this are not known, it is known that methylation is generally more pronounced at higher temperatures and lower oxygen environments, both of which are more likely under summer conditions than winter conditions.

Additionally, while many unknowns surround the flouring of elemental Hg, the increased surface area and increased potential for downstream transport will likely enhance reactivity and transport to areas favorable to methylation (i.e., downstream reservoirs and wetlands). Moreover, resuspension of sediments containing Hg in oxygenated environments has been shown to increase levels of $Hg(II)_R$, which has been shown to be directly related to methylation rate. The only available data comparing tissue Hg levels under the influence of suction dredging and when no suction dredging was occurring indicate a decrease in tissue Hg concentration under the no dredging condition that may not be attributable to inter-annual variability or hydrologic conditions alone. Overall, available data show that suction dredging of sediments with elevated THg concentrations and deposits of elemental Hg can be a principal source of concern for producing higher THg concentrations in downstream deposition zone sediments than would otherwise occur from discharges only of natural watershed loading events. Moreover, such mobilized sediment containing high THg and $Hg(II)_R$ concentrations results in increased MeHg production in reservoirs or the Delta where these Hg-laden sediments are deposited. On the contrary, mobilized sediment containing average sediment Hg concentrations has been shown to have no effect on measurable effect on MeHg production in a downstream reservoir or the Delta.

Finally, the Office of Environmental Health Hazard Assessment has documented and issued consumer fish consumption advisories due to elevated levels of Hg in fish tissue for numerous areas of California that were historically affected by Hg ore mining, and in some of the areas where gold mining occurred and elemental Hg was used extensively. Concentrations of Hg in fish tissue in these areas are also above criteria developed for the protection of mammalian and avian wildlife, and occasionally exceed levels that have been found to adversely affect fish health or reproduction. Fish tissue Hg levels have been correlated to MeHg levels in sediment, which in turn have been correlated with THg levels in sediment.

Based on the information discussed above, suction dredging has the potential to contribute substantially to: (1) watershed Hg loading to downstream reaches within the same water body and to downstream water bodies, (2) MeHg formation in the downstream reaches/water bodies, and (3) bioaccumulation in aquatic organisms in these downstream reaches/water bodies. Available evidence suggests that these processes associated with suction dredging in the Sierra foothills, for example, may increase Hg levels in reaches/water bodies downstream of suction dredging areas by frequency, magnitude, and geographic extent such that MeHg body burdens in aquatic organisms may be measurably increased, thereby substantially increasing the health risks to wildlife (including fish) or humans consuming these organisms. Therefore, this impact is considered a potentially significant impact.

Potential mitigation measures to reduce the impact would necessarily involve actions to avoid or limit THg discharge from areas containing elevated sediment Hg and/or elemental Hg from suction dredging activities under the Program. Such discharge limiting actions could include the following:

- Identify river watersheds or sub-watersheds where sediment Hg levels are elevated above regional background levels or where elemental Hg deposits exist and establish closure areas to avoid suction dredging within these areas. No such data currently exist to comprehensively identify Hg "hot-spots"; however, data, especially from Sierra Nevada watersheds impacted by mining, suggest that sediment mercury levels at these sites are elevated above background levels. Hence, this action could involve a phased study to identify the presence of such areas based on intrinsic properties including proximity to mines, hydraulic and channel features, and other factors.

- Limit the allowable suction dredge nozzle size and/or allowable seasonal duration of dredging activity within water bodies known to contain sediment elevated in Hg or that contain elemental Hg deposits. Although smaller nozzle sizes would still cause mercury releases when dredging mercury enriched sediment, the amount of mercury discharged would be lower than with larger nozzle sizes.
- Implement a special individual permit system for suction dredge operators for areas where Hg "hot-spots" exist. The permit system would be designed to require assessment of the area prior to initiation of dredging activity and issuance of terms and conditions to ensure that Hg hot-spots are identified and avoided or other provisions are implemented to ensure that the dredging activity does not result in substantial discharge of Hg downstream from the site.

Implementation of such mitigation actions, implementation procedures, monitoring, and enforcement may reduce potential impacts. However, because not all locations of elemental mercury deposits are known, the feasibility with which sites containing elemental mercury could be identified at a level of certainty that is sufficient to develop appropriate closure areas or other restrictions for allowable dredging activities, is uncertain at this time. Moreover, at this time the Program allows for suction dredging activities to occur on a statewide basis within areas known to contain historic gold mining sites and sediments contaminated with elemental mercury. Thus, a comprehensive set of actions to mitigate the potential impact through avoidance or minimization of mercury discharges has not been determined at this time, nor is its likely effectiveness known. It should be noted that a program of feasible and adequate mitigation actions may be developed that includes the phased implementation of actions in combination with adaptive monitoring and evaluation measures. This impact would remain potentially significant until such time that a sufficient and feasible mitigation program is developed but there is no guarantee that this type of mitigation is practicable. This impact is considered significant and unavoidable.

Impact WQ-5. Effects of Resuspension and Discharge of Other Trace Metals from Suction Dredging (Significant and Unavoidable)

Implementation of suction dredging under the Program may result in dredging activity occurring in areas within California where the sediments could contain relatively elevated concentrations of trace metals other than Hg (e.g., copper, lead, zinc). Historic copper, lead, and silver mines are located throughout the Sierra Nevada, and copper, lead, silver, and zinc mines are located in the Klamath-Trinity Mountains. Trace metals levels in sediments in Sierra streams have not been thoroughly evaluated, with the exception that specific mining cleanup projects may have site-specific data (e.g., Iron Mountain Mine, located adjacent to Spring Creek and other tributaries to the Sacramento River near Redding). As identified in Table 4.2-1 above, the RWQCBs have identified numerous stream segments on the 303(d) list of impaired water bodies for various trace metals. Many 303(d) listed water bodies are lower elevation bays and enclosed estuaries where the historical industrial sources are the cause for listing. However, the upper Sacramento River watershed includes several 303(d) listed streams near well-known mining areas which are affected by acid mine drainage

- Section 228(j)(3): requires that the intake for the suction dredge pump be covered with screening mesh, which effectively eliminates the potential for entrainment of juvenile salmonids into the pump intake.
- Section 228(k)(16): requires dredgers to avoid the disturbance of fish.

While some entrainment of juveniles and adult *Fish* species is likely to occur, it is avoided or minimized based on spatial and temporal restrictions on dredging, and the operational requirements outlined above. Thus, with respect to Significance Criteria A and D, the impact is considered less than significant.

Impact BIO-FISH-5: Behavioral Effects on Juvenile or Adults (Less than Significant)

Discussion

Effects on Fish

Fish behavior can be altered as a result of numerous environmental changes and stimuli. Silt deposition as a result of mechanized activities, such as suction dredging, can have adverse effects on invertebrates and fish, including clogging of respiratory structures, reduced feeding rates, increased invertebrate drift, disruption of courtship displays and spawning behavior, and reduced hatching rates in fish (see Murphy et al., 1995 for review).

Fish behavioral responses to noises and vibrations generated by dredging have not directly been quantified, but observations have shown a range of fish behavior changes to anthropogenic noises and human activity. Fish as well as other vertebrates are capable of detecting a wide range of stimuli in the external environment (Feist and Anderson, 1991). The modalities most often detected include sound, light, chemicals, temperature, and pressure. The response of fish to sounds in their environment is varied. The classic fright response of salmonids to sound is the "startle" or "start" behavior (Moore and Newman, 1956; Burner and Moore, 1962; VanDerwalker, 1967). These behaviors involve sudden bursts of swimming that are short in duration and distance traveled (usually <60 cm; Feist et al., 1992). Responses of other fish to sound include packing or balling, polarizing, increases in swimming speed, diving, or avoidance (Hering, 1968; Olsen, 1976). Few studies have shown that sound can attract or repel salmonids over great distances or for long periods of time (McKinley and Patrick, 1986).

Mueller et al. (1998) subjected 30-70 mm rainbow trout (*O. mykiss*) and Chinook salmon (*O. tshawytsha*) fry to low (7-14 Hz) and higher frequency 150, 180, and 200 Hz (similar to small combustion engines) sound fields to assess the possibility of using underwater sound as a behavioral barrier for enhancing fish screening facilities. Both species responded to infrasound by an initial startle response followed by a flight path away from the source and to deeper water. These observations indicate that juvenile salmonids, as small as 30 mm long, have infrasound detection capability. They also observed a startle response in wild Chinook salmon when exposed to high-intensity (162 dB //mPa), 150-Hz pure tone sound; but no observable effects were noted on hatchery Chinook salmon or rainbow trout fry when exposed to 150, 180, or 200 Hz high-intensity sound. Therefore, the noise generated by a suction dredging motor may have mixed behavioral effects on juvenile salmonids, depending on species, age and origin.

Very little work has been done on the effects of diving and other human activity on the behavior of stream fishes. Hassler et al., (1986) observed trout actively feeding behind suction dredging operations. However, this was a qualitative assessment and did not directly measure changes in individual fish behavior or the overall effects on the fish population. More recent work has been done on the effects of tourist diving on marine reef fishes. Ilarri et al. (2008) observed that diversity, equitability and species richness were significantly higher at a Brazilian coral reef when divers were absent. How well these results translate to California streams is unclear, but it is reasonable to assume based on the available literature that diving activity in association with equipment operation can affect fish behavior.

While some work suggests that adult spring-run Chinook salmon behavior is unaffected by suction dredging (Stern, 1988), o her studies suggest that different disturbances (e.g., recreational activity) increased salmon movement in pools, and may increase adult stress (Campbell and Moyle, 1992). Even minor disturbances during the summer may harm adult anadromous salmonids because their energy supply is limited, and the streams they occupy can be near lethal temperatures (Nielsen et al., 1994). The USFS (2001; 2009 states that suction dredging can disturb spring Chinook salmon holding in deep pools during the summer, particularly if numerous dredges are operating, or if water temperatures are elevated. Suction dredging dislocates and can kill aquatic insects used as a food source by a variety of fish species in a variety of life stages. If animals avoid a refuge area as a result of disturbance or perceived predation (Frid and Dill, 2002), these animals may experience greater predation by other predators (Crowder et al., 1997; Sih et al., 1998; De Goeij et al., 2001). If forced to relocate to new feeding areas, fish may experience increased stress due to predation, exposure to sub-optimal conditions, and increased competition with other fish for food and space, as well as stress from agonistic behavior (i.e., contests for dominance).

Effects on Amphibians

Responses by adults and metamorph amphibians to noise and vibrations have not been quantified; however, avoidance by individuals of disturbances is likely. Research shows that abundance of Iberian frogs (*Rana iberica*) has been reported to decrease with proximity to recreational areas (Rodríguez - Prieto and Fernández - Juricic, 2005). Human visitation along streambanks resulted in 80 to 100 percent decrease in frog use with a five - fold and 12 - fold increase in direct disturbance (Rodríguez - Prieto and Fernández - Juricic, 2005). Avoidance behaviors by frogs to humans, including suction dredgers, could remove individuals from an existing established territory, and push them into either marginal or unsuitable habitat or into a new, already occupied territory, potentially impacting the relocated individual and the defending individual, expending critical energy reserves.

Findings

If left unrestricted, impacts of suction dredging on the behavior of juvenile and adult *Fish* would be potentially significant with respect to Significance Criteria A and D. Behavioral impacts are of particular concern during mating, spawning and early life stages. The Proposed Program regulations incorporate spatial and temporal restrictions on suction dredging in the period immediately before spawning/breeding and during critical early life stages of *Fish* action species (i.e., incubation, development, early emergence) (Table 4.3-1). The Proposed Program regulations also include specific closures of areas within streams that are known to provide thermal refugia (i.e., cold water holding pools) for Chinook and coho salmon in the Klamath River basin (Appendix L). Closures of these areas provide for protection of organisms and maintenance of stream features that serve as habitat during stressful periods (e.g. over-summer habitat for juveniles). Therefore, the potential to stress holding adults and/or juveniles of these species from actions associated with suction dredging is not likely to commonly occur. In addition, the following regulations would further minimize the potential for suction dredging to result in behavioral effects on fish and amphibians:

- Section 228(k)(16): requires dredgers to avoid the disturbance of fish.

With the Proposed Program regulations in place, impacts related to behavioral effects would be avoided and/or minimized. Thus, with respect to Significance Criteria A and D, the impact is considered less than significant.

Impact BIO-FISH-6: Effects on Movement/Migration (Less than Significant)

Discussion

Effects on Fish and Invertebrates

Aquatic organisms such as fish and invertebrates migrate or move to spawn, feed, seek refuge from predators, and escape harmful environmental conditions or access more productive areas (see Fausch et al., 2002). The success of migration, whether upstream, downstream or laterally (to floodplain and off channel habitat) is limited by the presence of barriers that can impede passage (Meixler et al., 2009). Barriers to movement can either be physical (e.g. water that is too shallow, fast or hot) or behavioral (perceived or real danger) in nature. Direct and indirect impacts related to creating passage issues for migrating fish include:

- Blockage: Both complete and partial
- Fatigue: Can't complete immediate passage or reduced ability to complete migration or life strategy
- Vulnerability: Predation and disease
- Injury: Impact, scrapes and abrasions
- Desiccation: tissue damage or reduction in gill function due to being out of water for prolonged periods
- Disorientation: Fish cannot find pathway or access to passage, impeding or reducing migration success

Whether human activity or a change to the channel is a barrier to fish movement depends on the several factors including: the amount or frequency of noise generated by the activity; the physical and hydraulic features of the channel alteration and the physiology; and life stage and behavior of the fish (Bell, 1990; Webb, 1995). This can change with species and age of fish and acclimation of the organism over time (Davidson et al., 2009). Such activities may create velocity, depth, and slope conditions that fish cannot physically overcome, may disorient fish, or fish may avoid such conditions.

Effects on Amphibians

For most amphibians, the metapopulation concept of population biology applies, which is defined as populations that are spatially structured in assemblages of local breeding populations, with their own independent dynamics, and migration among the local populations has some effect on local dynamics, including the possibility of population reestablishment following extinction of any one of the local populations (Whittaker, 1998).

Movement per generation is of a lower rate in amphibians than in invertebrates, mammals or reptiles, and low recruitment of dispersing individuals probably plays an important role in decline and extinction in amphibian populations in fragmented landscapes (Cushman, 2006). A number of studies have indicated that populations may decline if immigration is prevented and may not be recolonized following a local extinction (Cushman, 2006).

For the smaller vertebrates, such as amphibians, movement could be impeded if suction dredgers are densely active or consistently active within a season within a stream corridor. Movement from the main channel into small tributaries, or vice versa, may be impeded by suction dredging. Suction dredging could also result in the sterilization of a once viable and active movement corridor along the littoral area, thus barring movement.

Interruption of movement or dispersal corridors can be detrimental to small populations of amphibians. The viability of a population is dependent on movements between populations, and without such movements, populations become susceptible to loss of genetic diversity by random drift and, ultimately falling to the effects of inbreeding (Beebee and Griffiths, 2005). Connectivity appears to be of particular importance even in unfragmented landscapes, as amphibian populations experience relatively frequent local extinction and turnover (Cushman, 2006). Thus movements and dispersal are critical for recolonization of local populations and maintenance of regional populations.

<u>Findings</u>

If left unrestricted, impacts of suction dredging on movement would be potentially significant with respect to Significance Criterion D. However, the Proposed Program incorporates spatial and temporal restrictions on suction dredging activities within the range of *Fish* action species. Streams within the state that provide habitat for species that are either very limited in number and/or distribution are proposed to be closed to suction dredging (Class A), thus avoiding the potential for impacts. These restrictions are intended to maintain the viability of these species, as disruptions of migration or movement may have a substantial effect on the population or range of the species. Areas of the state designated Class B through G similarly provide direct protection for *Fish* action species and surrogate protection for the movement and migration of many other species (Appendix J, Tables J-1 and J-2). In addition, the following Proposed Program regulations would further minimize the potential for impacts to migration and movement of *Fish*:

- Section 228(c)(2): requires dredgers to provide CDFG with information regarding the location of their dredging operation(s). This will allow CDFG to monitor and manage areas with high dredging use, and potentially modify regulations if deleterious effects are identified.
- Section 228(k)(6): Prohibits the diversion of a stream into the bank.

- Section 228(k)(4): prohibits the removal or damage of streamside vegetation. Terrestrial invertebrates can make up a significant portion of a fish's diet during some periods (Nakano and Murakami, 2001; Garman, 1991). Riparian trees and other vegetation are the source of these organisms. Prohibiting the removal of riparian vegetation will help maintain this component of the prey base.
- Section 228(k)(5): prohibits the cutting, movement or destabilization of woody debris, which is important for macroinvertebrate habitat and production.

Thus, with respect to all significance criteria, this impact is considered less than significant.

Impact BIO-FISH-8: Creation and Alteration of Pools and other Thermal Refugia (Less than Significant)

Discussion

Stream pools provide important habitat for aquatic organisms such as amphibians (Wilkins and Peterson, 2000) and fish, including refuge from bird and mammal predation (Harvey and Stewart, 1991). Pools that provide coldwater (or thermal) refugia are important to salmonids and other fishes as both over-summering juvenile and adult holding habitat. For instance, adult spring Chinook salmon returning from the ocean in late spring migrate upstream, hold in cooler river reaches during the summer months, and then spawn in the fall when stream temperatures become more tolerable. Adult salmon cease to feed upon entering freshwater and, therefore, function on energy reserves until spawning. Because salmon metabolic rates increase directly with temperature, high water temperatures prior to spawning compromise energy necessary to insure reproductive success. Therefore, coldwater refugia are important stream components (Torgersen et al., 1995). These sites also provide refuge for macroinvertebrates, herpetofauna and other fish species.

Suction dredging activities have the potential to result in creation, alteration or destruction of pool habitat. The act of dredging often creates pools locally, but these features may not be persistent, nor function hydrologically in a manner similar to naturally formed pools. Suction dredging can alter or destroy pools by redistributing stream substrate in a manner that would destabilize bed form, or simply by filling a pool with dredge tailings (See Chapter 4.1, *Hydrology and Geomorphology* for a more detailed discussion of dredging impacts to channel form and function).

Temperatures within streams may be affected by surface discharge, but a primary effect is connectivity with the hyporheic environment (i.e. beneath and lateral to the streambed) (Ebersole et al., 2001). Other effects on temperature include solar radiation and ambient air temperature. This is further influenced by solar declination, length of day and shading. Pool depth and water residence time will affect mixing, how much energy is stored in the water and therefore the temperature within the area. In-stream structures such as log jams, riffles, and gravel bars are common in natural streams and stream restoration projects, and are also known to enhance hyporheic exchange (Kasahara and Wondzell, 2003) affecting channel temperatures (Hester et al., 2009). Suction dredging may affect the ability of a section of stream to provide thermal refuge in several ways; dredging a hole that allows the connection of surface water to the hyporheic zone is one aspect. Another is affecting the porosity of the substrate that in turn affects hyporheic flow.

Filling of pore spaces between coarse gravel and cobble at the bottom of pools can reduce the use of such habitat by amphibians (Welsh and Olliver, 1998). Suction dredging can lead to sedimentation of pools downstream of the dredging site, thus filling in pool habitat. For example, after one year of dredging activity on Gold Creek in Missoula County, Montana, all of the gravel deposited at the dredged area had moved downstream and completely filled in a downstream pool (Thomas, 1985). However, the authors of this study found, overall, that the creation of a pool at the dredged site led to no net loss of pool habitat in the stream.

It is unclear how sustainable pools created by dredging activity are compared to those that develop under more natural conditions. Where pools form, their size and how they are maintained is dictated by gradient, sediment source, substrate size, channel width, flow and the presence of forcing features (e.g., bedrock outcropping, boulders, wood material) (MacWilliams et al., 2006). These factors are rarely, if ever, considered by suction dredgers when creating pools.

Findings

If left unrestricted, impacts of suction dredging on thermal refugia would be potentially significant with respect to Significance Criteria A, B and D. More specifically, unrestricted dredging of thermal refugia utilized by Chinook salmon in the Klamath and Salmon River watersheds could result in a substantial decline of the species, alteration of thermal refugia habitat, and affect movement of the species within summer holding areas. However, the Proposed Program regulations include specific year-round closures of areas within streams that are known to provide thermal refugia for this species (Appendix L). Closures of these areas, and appropriate buffers in the upstream direction, will provide protection for this type of habitat. In addition, the following Proposed Program regulations would further minimize the potential for suction dredging to alter or otherwise degrade pool habitat:

- Section 228(k)(5): prohibits the cutting, movement or destabilization of woody debris, which is important for pool habitat formation and maintenance.
- Section 228(k)(15): requires dredgers to level all tailing piles prior to working another excavation site or abandoning the excavation site. This regulation would limit the potential for dredgers to leave tailings that could be easily transported downstream and fill pools, and plug or reduce hyporheic flow in critical areas.

With the Proposed Program regulations in place, impacts related to alteration of pool and thermal refugia habitat would be sufficiently avoided and/or minimized. Thus, with respect to Significance Criteria A, B and D, the impact is considered less than significant.

Impact BIO-FISH-9: Destabilization/Removal of Instream Habitat Elements (e.g., Coarse Woody Debris, Boulders, Riffles) (Less than Significant)

Discussion

This section primarily discusses the biological effects of destabilization/removal of instream habitat elements. The effects on channel form and function are discussed in Chapter 4.1, *Hydrology and Geomorphology*. For the purposes of this discussion coarse woody debris (CWD), also commonly referred to as large woody debris or LWD, refers to and fall months due to seasonal restrictions for other species). Thus, the potential for substantial disturbance to fairy shrimp and their habitat would be minimized because when vernal pools are dry the organisms are in a life stage that is relatively resilient to disturbance (i.e., cyst form), and (2) the habitat would be less prone to disturbance/degradation that may be caused by ancillary suction dredge activities (e.g., encampments).

In the case of Trinity bristle snail and valley elderberry longhorn beetle, there would be a somewhat higher potential for impacts due to dredging because their life cycles are not timed such that they enjoy surrogate protection from disturbance by activities that are ancillary to dredging. Thus, it is likely that some level of disturbance to terrestrial/non-riverine aquatic invertebrates would occur. However, the level of impact associated with activities that are ancillary to dredging (e.g., camping, access and egress) is not likely to result in a substantial adverse effect to any special-status terrestrial/non-riverine aquatic invertebrate species. Thus, with respect to Significance Criteria A, B and C, the impact is considered less than significant.

Impact BIO-WILD-2: Effects on Special-Status Passerines Associated with Riparian Habitat (Significant and Unavoidable)

Discussion

Recreational activities, such as suction dredging, may impact special-status passerine[3] species by altering behavior, movements and distributions, which may lead to nesting failure and expenditure of critical energy reserves (Knight and Skagen, 1986). Human activity, including mechanical noise, can alter bird species composition associated with the activity area, causing nest abandonment, increased nest predation, and discouragement of late-nesting birds from settling in disturbed areas (Ellison and Cleary, 1978; LaGory et al., 2001).

Specific disturbance mechanisms include noise associated with dredge rigs, dredgers accessing streams, direct disturbance of riparian habitat, alteration of prey resource base, and suction dredging encampment activities at night (e.g., lights and noise). Suction dredging activities that occur during the passerine breeding season (typically March through August) may alter behavioral patterns of special-status passerines species such as Bank Swallow (*Riparia riparia*), Western Yellow-billed Cuckoo *(Coccyzus americanus occidentalis),* Least Bell's Vireo (*Vireo bellii pusillus*) and Willow Flycatcher (*Empidonax traillii*) (Table 4.3-3). In some cases this may prevent individuals from continued nesting in a section of their territory or result in nest abandonment (even temporary), causing mortality to eggs or nestlings.

Findings

Suction dredging and associated activities may cause impacts to special-status passerines species and their habitats that would be considered potentially significant with respect to Significance Criteria A, B and D. Table 4.3-3 list the special-status passerines species for

[3] Passerines are birds belonging to the order Passeriformes, a large subset of birds that have evolutionary traits adapted for perching.

which a potentially significant impact may occur in the absence of regulations. As discussed in Table 4.3-3, the Proposed Program regulations incorporate spatial and temporal restrictions based on *Fish* action species that would provide partial or full surrogate protection for nesting passerines within portions of these species' ranges. The following Proposed Program regulations, though not specifically intended to do so, would further minimize the potential for suction dredgers to impact nesting passerines species and their habitats:

- Section 228(k)(3): prohibits dredging within 3 feet of the lateral edge of the current water level. This will minimize potential disturbance to nesting habitat for a variety of passerines including Bank Swallow.
- Section 228(k)(4): prohibits the removal of streamside vegetation. This will minimize potential disturbance to nesting habitat for a variety of passerines including federally protected passerine species such as Willow Flycatcher and Least Bell's Vireo.

Potential for impacts to special-status passerine species would largely be minimized with incorporation of the Proposed Regulations, but not completely avoided. The potential for direct disturbance of nests or adverse behavior modifications due to human activity would remain. For several of these species (e.g., Least Bell's Vireo), even a small disturbance could be substantial considering the restricted population and/or range of the species in question. Thus, for those passerine species listed in Table 4.3-3, the level of impacts would remain potentially significant with respect to Significance Criterion A.

Mitigation measures are available to reduce impacts to a less-than-significant level for passerines that may be affected by a project. These mitigation measures include research using the CNDDB and other sources to identify potential locations of species, field surveys by qualified biologists to determine the location of sensitive passerines prior to dredging activities, and implementation of seasonal avoidance measures (e.g., buffers around known nests during the breeding season). Despite the advisory information that will be contained in the "Best Management Practices" packets to avoid such adverse effects, CDFG does not have the jurisdictional authority to adopt or enforce mitigation for impacts to non-*Fish* species under this program. Therefore, impacts to these passerine species are considered significant and unavoidable.

Impact BIO-WILD-3: Effects on Special-Status Raptors Associated with Riparian Habitat (Less than Significant)

Discussion

Recreational activities, such as suction dredging, may impact raptor species by altering behavior, movements and distributions, which may lead to nesting failure and expenditure of critical energy reserves (Knight and Skagen, 1986). Human activity and associated noise can increase nest desertion by adults and reduce success in fledging young (White and Thurow, 1985). Specific disturbance mechanisms include noise associated with dredge rigs, dredgers accessing streams, and direct disturbance of suitable riparian habitat. Suction dredging activities that occur during the raptor breeding season (typically March through August) may alter behavioral patterns of individual birds and potentially prevent special-