Greene Environmental Services
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April 16, 2013

SUBJECT: Please vote NO on SB838 and YES on SB838-1

Chairman Jackie Dingfelder and Committee Members
Senate Environment and Natural Resources Committee

Dear Chairman Dingfelder and Committee Members:

Please include these comments in the public record.

While I am generally pleased with the neutral position taken by the Oregon American Fisheries Society (ORAFS)in support of small-scale gold suction dredging I have concerns for some issues that I believe were overstated or of concern. Some concerns expressed in the white paper have been addressed.

SALMONID SPAWNING ON DREDGE TAILING PILES

ORAFS stated, "The tailings from suction dredges often form mounds of loose and unconsolidated gravels and cobbles on which some salmonids (particularly coho salmon, Chinook salmon, or bull trout) may construct redds (USDA Forest Service 2001). Harvey and Lisle (1999) found that when fish deposit eggs on these dredge tailings, eggs and subsequent developing larval fish can be lost as tailings are easily displaced during annual high flow events."

I agree with what ORAFS has stated here except that the citation is incomplete and suggests a bias towards small-scale gold suction dredge tailing piles harming fish. The larger data set appears to suggest otherwise. I respond by citing what else was stated in the report by Harvey and Lisle (1999). They wrote:

"The proportion of Chinook salmon that spawn on dredge tailings would influence the population level effect of tailings and **depend, in part, on the availability of spawning sites on natural substrates**.

If natural spawning sites were relatively abundant and tailings were not strongly selected, a small fraction of redds would be located on tailings.

Scour of chinook salmon redds located on dredge tailings exceeded **scour of redds on natural substrates**, although the difference varied among streams.

However, **where natural spawning substrate is in short supply, a large proportion of redds may be located on dredge tailings**."

I summarize this to mean that if suitable natural substrate supply is adequate salmonids will use it. If suitable natural substrate is in short supply the salmonids may use the available small-scale gold suction dredge tailing piles or build redds over previously built redds in the suitable natural substrate thereby destroying them. Furthermore, during the study scour was also occurring in redds spawned on suitable natural substrate.

A review of the literature to determine just how serious the spawning of salmonids on small-scale gold suction dredge tailing piles might be revealed the following:

1. Approximately **60 salmonid redds** were observed in a study on Canyon Creek, CA. **None** of the redds were found within dredge tailing piles. *Stern, G. R. 1988. Effects of Suction Dredge Minin on Anadromous Salmonid Habitat in Canyon Creek, Trinity County, California. Masters Degree Thesis, Humbolt State University, 80p*.
2. "In the lower 6.8 mi of the Scott River in 1995, **only 12 of 372** (3.2%) redds were located on tailings because much more natural substrate than dredge tailings provided spawning habitat and fish exhibited no strong preference for either substrate." J. Kilgore, U.S. Forest Service, unpublished data. "However, where natural spawning substrate is in short supply, a large portion of redds may be located on dredge tailings." *HARVEY, B. C. and T. E. LISLE. 1999. Scour of Chinook Salmon Redds on Suction Dredge Tailings. North American Journal of Fisheries Management 19:613-617.*
3. Suction dredge mining was present throughout the Klamath River mainstem survey from the I-5 Bridge to Happy Camp. There were **only two redd** (0.127%) observed on suction dredge tailings. The fall chinook redd count of **1,578** was the fourth highest number observed since the initiation of these surveys in 1993. *Magneson, M., P. McNeil , andT. Shaw. 2001. Mainstem Klamath River fall Chinook salmon spawning survey 2001. U. S. Fish and Wildlife Service, Arcata Fish and Wildlife Office, Arcata Fisheries Data Series Report 2006-02, Arcata, California.*
4. The 2002 fall Chinook salmon redd count of **4,652** was the highest combined total for the six reaches of the mainstem Klamath River surveyed since the initiation of these surveys in 1993.

   Suction dredge mining was present throughout the survey from the Highway I-5 Bridge to Happy Camp. **Only one redd** (0.02%) was observed in 2002 on suction dredge tailings. *Magneson, M., P. McNeil , and T. Shaw. 2001. Mainstem Klamath River fall Chinook salmon spawning survey 2001. U. S. Fish and Wildlife Service, Arcata Fish and Wildlife Office, Arcata Fisheries Data Series Report 2006-02, Arcata, California.*
5. A total of **1,186** Fall Chinook salmon redds were counted in the mainstem Klamath River between Iron Gate Dam and the confluence of Indian Creek. Suction dredge mining was present throughout the survey from Ash Creek to Happy Camp. **No redds** were observed in 2006 on suction dredge tailings. *Magneson, M., R. Studebaker, and J. Ogawa. 2008. Mainstem Klamath River Fall Chinook Salmon Spawning Survey 2006. U. S. Fish and Wildlife Service, Arcata Fish and Wildlife Office, Arcata Fisheries Data Series Report Number DS 2008-13, Arcata, California.*

I believe these report succinctly summarize that less-than-significant effect of small-scale gold suction dredge tailing piles on the spawning choices and survival of salmonids.

THE EFFECT OF SMALL-SCALE GOLD SUCTION DREDGING ON SENSITIVE EARLY LIFE STAGES (eggs, sac-fry, alevin)

The ORAFS White Paper states, "… other studies have documented lower survival, particularly at early life stages, for fish populations proximate to suction dredge mining activity.

We encourage that suction dredge mining be prohibited or greatly reduced where sensitive fish stocks utilize reaches for spawning or where other sensitive life history stages are present."

Science has shown that if early life stages are sucked through a small-scale gold suction dredge, depending on the particular stage of growth, mortality as high as 100% can occur. The Oregon Department of Fish and Wildlife recognizes this concern and has, for several years, published in-water-work-periods. This is the time of year where the sensitive life stages have departed the rivers and work in the rivers and streams can commence with a less-than-significant effect on sensitive life stages. Actually, in this case, no effect because they are not present.

MOBILIZATION OF TOXIC MERCURY

The ORAFS went on to say, "Mercury and other heavy metals have been shown to have substantial health risks to wildlife and humans, through the consumption of contaminated fish or shellfish (see ORAFS 2011 for a review). Specifically, mercury is a highly potent neurotoxin that impacts the function and development of the central nervous system in both people and wildlife. When mobilized from substrates, mercury is more easily converted to a form that can move through the food chain and can eventually concentrate in fishes."

This view is lacking current scientific thought on the subject relative to toxicity and the impact of mercury mobilization from the operations of small[scale gold suction dredges.

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.

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.

Peterson (2009) research supports Ralston's (2005) 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

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The data discussed by Marvin-DiPasquale et al. 2011 is the same data collected in the studies discussed below. The comments are typical scare tactics that do not recognize data such as the following.

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)

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/cm^3 and copper at 8.92 g/cm^3 have significantly lower densities than mercury at 13.55 g/cm^3. 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.

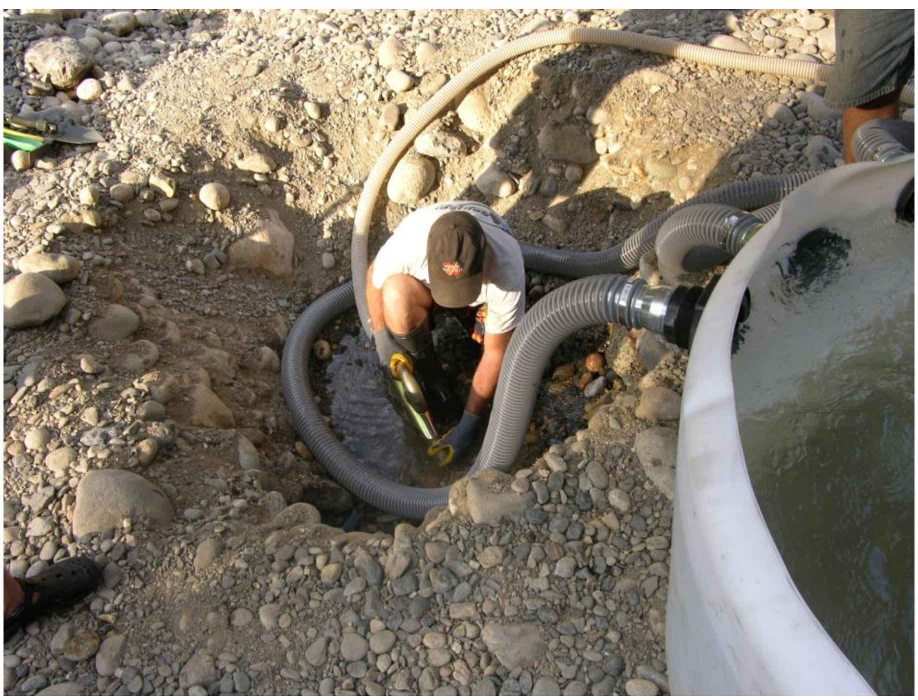
What value is there to the public interest when a federal agency, such as USGS, forms the hypothesis of a worst case scenario regarding small-scale suction dredging based on a study performed without using a suction dredge? A project where no suction dredge measurements were taken will never be a substitute 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.



This is not a small-scale gold suction dredge although it was used as a surrogate for one in this California gold suction dredge study onshore beside the Yuba River

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.

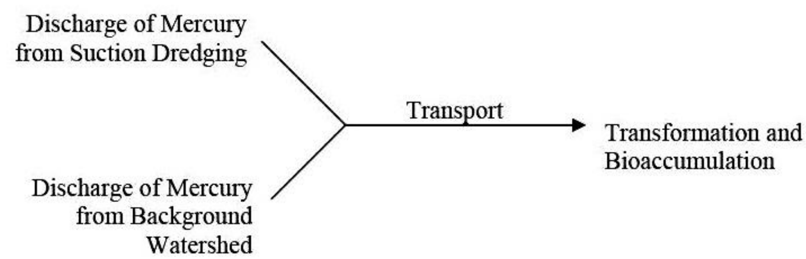


FIGURE 4.2-3. CONCEPTUAL MODEL FOR THE MERCURY IMPACT ASSESSMENT

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 re-circulating 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 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.

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.

Sincerely,

Joseph C. Greene

Research Biologist
Small-scale gold suction dredger

CC: Alan Bates
Bill Hansell
Mark Hass
Alan Olsen