The Department of Environmental Quality indicates that in 2016, there were 156 individuals who applied for and paid the annual permitting fee. Because of the significant fee increase, the DEQ anticipates a 70% drop in the number of individuals participating in suction dredge mining. As a result, the net revenue impact to DEQ for the 2017-19 biennium is estimated to be $19,600, and $27,450 for the 2019- 21 biennium.
DEQ has also indicated that current resource levels only allow for 0.30 FTE to operate this permit. DEQ has indicated that to ensure proper permit oversight, an additional position (1.00 FTE) would be required. The new position would be classified as a Natural Resource Specialist 2, and is estimated to have an expenditure impact on the Department of $238,150 per biennia. Given the small amount of Other Funds revenue generated by the $250 fee, it is assumed most of the cost would have to be paid by the General Fund.

6/12/07 Workshop
Suction Dredge
Deadline: 6/22/07 Noon

State Water Resources Control Board
Division of Water Quality
P.O. Box 100
Sacramento, California 95812-0100
Fax: 916-341-5620
email: commentletters@waterboards.ca.gov

June 21, 2007

Subject: **SUCTION DREDGE MINING**

Dear Board Members,

The discussion of mercury, during your recent June 12 workshop, was brought to my attention and I have been asked to comment. Specifically, there was concern expressed regarding a paper published from your Board's Water Quality Division (Humphreys, 2005). This paper discussed mercury losses and recovery during small-scale suction dredging.

The Water Board has spent a lot of time and money on mercury remediation projects with limited success. In 2001 EPA, Region 9 located in San Francisco, California did collect mercury from miners very effectively. Collections of mercury are currently happening in Oregon and Washington through the states respective Division's of Ecology and with even greater success at miner's rallies.

The suction dredge community could provide the State with a source of help that is willing to do what they do best. Prospect for GOLD! In the event that they run across a hot spot of mercury miners would be willing to hand it over to a collection facility if such a facility existed. The idea you mentioned in your Board's Water Quality Division report (Humphreys, 2005) of paying the miner's for their efforts would help facilitate this plan.

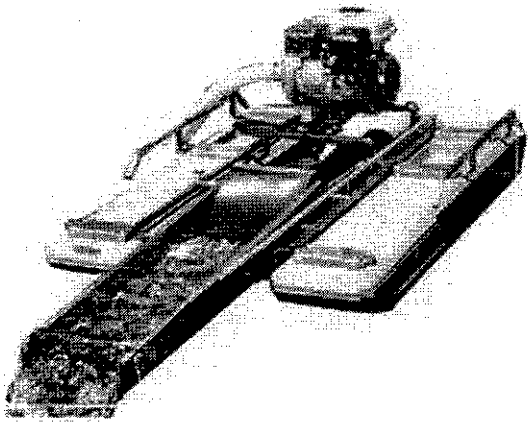
In reviewing your comments regarding possible problems associated with collecting mercury via suction dredging methods, I believe you are right to look to the suction dredge community for help locating hotspots and removing mercury from the river systems. The data provided in the report by Humphreys (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 results would have been much closer to 100 percent 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.

DESIGN OF NEW SMALL-SCALE SUCTION GOLD DREDGES

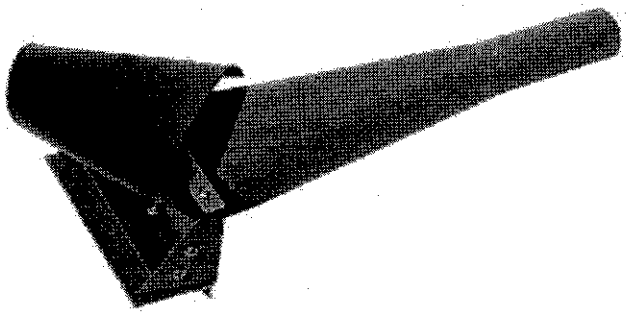
Before delving into the publication itself I would like to discuss new dredge technology that was overlooked in the planning of this study. The dredge style used in this study

has, at the head of the sluice, a "crash box". In the photograph below it is the black box to the right of the yellow engine (Ralph, 2003). I must also point out that this photograph does not illustrate normal operation of a dredge. Look at the wave of water in the sluice box. Running any dredge, using this water velocity, will surely wash the gold out of the sluice along with all the other bottom material.

Crashbox technology was replaced on the market 15 or more years ago. A jet flare now replaces the crashbox. An example of a modern Keene dredge using jet flare technology is illustrated below. You will notice that the crashbox has been removed (Keene, 2007a).



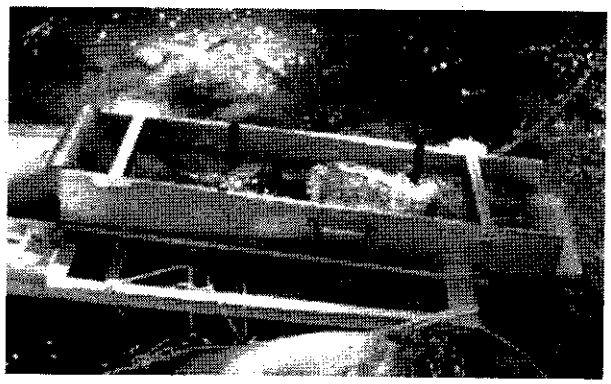
It has been replaced with a Jet flare (Keene, 2007b). The theory behind jet flare technology is that the water velocity drops off as the water and dredged materials leave



the 4-inch tube and enter the flared area that about 4-times the area of the intake. Therefore, it is unlikely that any flouring of elemental mercury would occur during the operation of the suction dredge.

In addition to using an obsolete dredge design, there was no discussion of the field crew's knowledge of proper operation of a suction dredge. These machines are not designed to start the engine, push the motor to maximum power (maximum suction) and begin mining. An experienced operator will check the water flow over the riffles in the sluice box to determine if the velocity is too high. If that is the case the operator will reduce the engine speed to adjust the water flow to a more acceptable velocity. Dredge motors are never run at maximum speed. It reduces engine life and in every case would put too much material and water through the sluice box.

The author of the site from which I borrowed the picture of the dredge with a crashbox was aware that it was operating poorly. So he removed the crash box and added a jet flare. Operation of the jet flare, on the same sluice box shown in the first illustration, is illustrated below (Ralph, 2003).



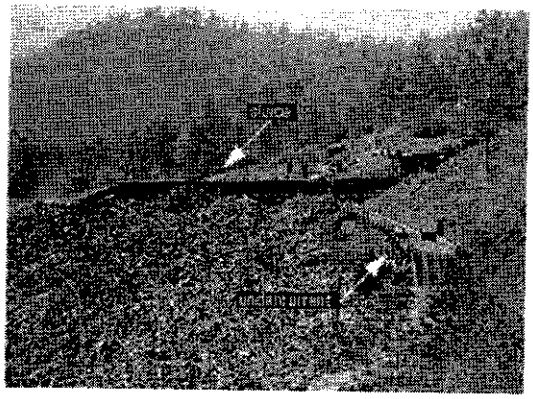
COMMENTS ON THE "MERCURY LOSSES AND RECOVERY" STAFF REPORT

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 relocated back onto the river floor buried in the sediment close to were 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.

Mercury can become floured. Alpers (2005) described this as, "gravel and cobbles that entered the sluice at high velocity caused the mercury to flour, or break into tiny particles. Flouring was aggravated by agitation, exposure of mercury to air, and other chemical reactions". In this case he was referring to a hydraulic mining sluice that contained materials that were roaring down a mountainside and fed by giant water cannons (monitors) that were used to breakup the gold bearing deposits.



(Alpers, 2005)

In the test described by Humphreys (2005) a small portion of floured mercury was collected in the sediments as they escaped the sluice box. This mercury whether floured before it entered the sluice box or not would still be in elemental form. No less toxic then the other 98 percent you are suggesting should 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.

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 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 move it downstream closer to, and eventually into, the bay and delta.

It is unclear from reading the report whether, or not, the floured mercury was already present in the river sediments. If one were to study the picture in the report that showed the results of panning materials from a nearby creek it does appear that was the case. Because the study was conducted in a seriously contaminated area if is impossible to determine what portion of flouring of mercury, if any, was caused by the crash box design of the suction dredge in use. If indeed the crash box caused the flouring then using a jet fare type suction dredge would eliminate the problem.

Reducing the amount of floured mercury, if it is in fact occurring, would be an easily eliminated problem by operating a modern jet flare style suction. The jet flare which is widely in use today, in the suction dredge mining community, is the best equipment available for collecting fine gold and because of this design and the density of mercury it would be extremely effective in collecting mercury particles with little disturbance that would result in further breaking the mercury particles down.

It is most important to reduce the total amount of mercury in the streams and rivers and its transported downstream into the bays and deltas. This is defined as a part of 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.

I hope the comments I have provided will be helpful in your efforts regarding suction dredge mining and water quality. I thank you for this opportunity to submit this data.

Respectfully,

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ARTICLE

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Selenium Moderates Mercury Toxicity in Free-Ranging Freshwater Fish.

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Supporting Information

ABSTRACT: Due to the extremely high affinity of selenium (Se) to mercury (Hg), Se sequesters Hg and reduces its biological availability in organisms. However the converse is also true. Hg sequesters Se, causing Hg to inhibit the formation of Se dependent enzymes while supplemental Se supports their continued synthesis. Hence, whether or not toxic effects accompany exposure to Hg depends upon the tissue Se:Hg molar ratio of the organism. The main objective of the present study was to investigate how levels of Hg and Se affected metallothionein (MT) induction in free-ranging brown trout, *Salmo trutta*, from Lake Mjøsa, Norway (a Se depauperate lake). MT is proposed as a sensitive biomarker of potential detrimental effects induced by metals such as Hg. Emphasis was addressed to elucidate if increased tissue Se:Hg molar ratios and Se levels affected the demands for MT in the trout. The Se:Hg molar ratio followed by tissue Se levels were most successful for assessing the relationship between metal exposure and MT levels in the trout. Thus, Hg in molar excess over Se was a stronger inducer of MT synthesis than tissue Hg levels in the trout, supporting the assumption that Se has a prominent protective effect against Hg toxicity. Measuring Hg in animals may therefore provide an inadequate reflection of the potential health risks to humans and wildlife if the protective effects of Se are not considered.

INTRODUCTION

Mercury (Hg) is considered a global environmental pollutant, and elemental mercury (Hg^0) is the predominant form of atmospheric Hg. Because Hg has a long residence time in the atmosphere, it is transported to and deposits in remote places far away from the sources.[1] Furthermore, Hg can be converted to methylmercury (MeHg), which accumulates in the food chain posing a potential threat to wildlife and human health.[2] The potent toxicity of Hg compounds is often associated with the high affinity of Hg for sulfur, causing an efficient biding to cysteine residues in proteins and enzymes, thereby perturbing their functions. Another mechanism for the toxicity of Hg has been attributed to its impact on the biochemical roles of selenium (Se).[3,4] Hg reduces the bioavailability of Se via the formation of insoluble Hg selenide species (Se−Hg complexes) perturbing the activity of Se-dependent functions (e.g., selenoenzymes). Conversely, Se also sequesters Hg, thereby reducing the biological availability and toxicity of Hg. However, irrespectively of Hg or Se sequestering the other, Hg toxicity is highly dependent on the Se status of the organism. Thus, whether or not toxic effects accompany exposure to Hg depends upon the tissue Se:Hg molar ratio of the organism.[4] A tissue Se:Hg molar ratio greater than 1 is suggested as a threshold for the protecting action of Se against Hg toxicity,[4−6] suggesting Hg exposure more hazardous when the Hg is in molar excess of tissue Se.

Induction of metallothionein (MT) is proposed to be an important mechanism for counteracting toxic effects elicited by metals such as Hg.[7] Although MT is considered as a detoxification system,[8] it is also proposed as a sensitive biomarker of potential detrimental effected induced by metal contamination.[9] All organisms have to cope with heavy metal stress, be it from exposure to nonessential toxic elements and from a depletion or excess of essential metals such as zinc and copper. Typical responses to metal exposure are the activation of transmembrane exporters, down-regulation of importers, transcription of inducers of genes encoding for synthesis of MT, and complexation of metals by conjugation to glutathione.[10] MT is a cysteine-rich protein with the capacity of binding (or scavenging) xenobiotic heavy metals (e.g., mercury and cadmium) via sulfhydryl groups of its cysteine residues. MT also participates in the uptake, transport and regulation of zinc, an essential element in biological systems. The zinc-dependent metal-responsive transcription factor 1 (MTF-1) helps to activate the transcription of MT via so-called metal-response elements (MREs).[11−13] Activation by heavy metals occurs indirectly due to metals ability to release zinc from MT thereby activating synthesis of more MT. Besides coping with heavy metals, MTF-1 can also mediate the induction of MT in response to other stimulants such as oxidative stress.[14]

Received: February 11, 2011
Accepted: June 15, 2011
Revised: June 13, 2011
Published: June 15, 2011

In this reaction of scavenging reactive oxygen species, cysteine in MT is oxidized to cystine, liberating zinc ions which activate synthesis of more MT.[12,15] The latter is important because many metals, including Hg, are suggested to trigger oxidative stress by inducing production of reactive oxygen species or by perturbing proper function of antioxidant defense systems (including perturbing effect of Hg on Se-dependent antioxidant defense systems such as glutathione peroxidase).[4]

In freshwater food chains, highest bioaccumulation of Hg is generally observed in piscivorous (fish-eating) species, and in particular large-sized and long-lived species such as the brown trout, *Salmo trutta*.[16] Hg concentrations in brown trout from Lake Mjøsa (Norway's largest lake) and other waterways in southeastern Norway [16,17] are higher than the current U.S. Environmental Protection Agency (0.3 mg/kg wet weight) and European Food Safety Authority (0.5 mg/kg wet weight) tissue-based criterions for the protection of humans.[18,19] Hg concentrations also exceed the wildlife threshold of 0.1 mg/kg.[20] Soils and waterways of north-central Europe and Scandinavia are also relatively depauperate of Se.[21] Thus, Hg in freshwater systems in this part of the world might therefore be more hazardous to wildlife and humans than currently recognized.

The main objective of the present study was to investigate how levels of Hg and Se and the Se:Hg molar ratio affect MT induction in free-ranging brown trout from Lake Mjøsa, which is a Se-depauperate lake with low Se concentrations in brown trout.[17] Particular emphasis was on the issue whether the fish with higher tissue Se, or higher tissue Se:Hg molar ratios reduces demands for MT following exposure to Hg. In fish, MeHg constitutes 95−97% of total Hg in filets.[22] Therefore, and because muscle tissues constitute the major reservoir of Hg in fish, total Hg measurement in this tissue was used to quantify the Hg exposure in trout of the present study. Because other metals (cadmium [Cd], lead [Pb], iron [Fe], copper [Cu], zinc [Zn], arsenic [As], gold [Au], aluminum [Al], manganese [Mn], cobalt [Co], nickel [Ni]) induce or down-regulate MT,[8,13,23−26] effects of these metals on MT levels were also integrated into the statistical models .

MATERIAL AND METHODS

Sampling. Brown trout (n = 32) were captured from boats in the northern part of Lake Mjøsa, Norway, close to Lillehammer City, in May 2008 using fishing rods. After capture, fish were kept alive onboard in large buckets filled with water. Water was replaced every 5−10 min to keep it oxygen-rich. Within 30−45 min from their capture, fish were brought to land for biometric measurements and tissue collection. Small pieces of liver were wrapped in aluminum foil and stored in liquid nitrogen. Muscle filets were placed in plastic bags and stored in a freezer (−20 °C) until analysis of metal concentrations. After arrival at the laboratory, liver samples were transferred from liquid nitrogen to a freezer for storage at −80 °C until analysis of MT levels.

Determination of Hepatic MT Levels. Prior to MT analysis a piece of liver tissue (0.10−0.15 g) was homogenized in a glass tube using Potter-Elvehjelm's technique. Tris-buffer (Sigma-Aldrich, 20 mM, pH 7.4) was added in a 1:9 ratio relative to the tissue weight. The homogenate was centrifuged (10 000g, 10 min, 4 °C) before the supernatant was aliquoted to new Eppendorf tubes and stored at −80 °C. A new scalpel blade was used for each sample. The glass tube and the homogenizer were cleaned thoroughly with deionized water and air-dried between each sample. The samples were kept on ice during the entire homogenization procedure to prevent degradation of proteins.

The MT content of the liver was determined using a Cd-saturation method described by Bartsch et al.[27] By adding a mixture of a radioactive Cd-isotope ($^{109}Cd^{2+}$) and nonradioactive Cd^{2+} to a sample containing MT, the MT concentration of the sample could be determined using a gamma counter. Cd binds to all free binding sites on MT, and replaces metals to which MT has a lower affinity. High molecular weight proteins that could interfere with the assay were denatured by adding acetonitrile (C_2H_3N, Merck KGaA) to the samples before adding Cd. The ion-exchanger Chelex-100 resin (Bio-Rad) was added to remove excess ^{109}Cd. When the Chelex was removed by centrifugation, all the remaining ^{109}Cd was bound to MT in the supernatant.

Two duplicates were prepared from each individual sample, 100 μL of liver supernatant was used in each tube. Two blanks were prepared on buffer (10 mM Tris-HCL, 85 mM NaCl, pH 7.4) instead of sample supernatant; apart from this they were treated the same way as the liver samples. Adding Cd-mixture and Chelex-100 resin to the blanks ensured that the amount of Chelex were sufficient to remove all the Cd available in the assay. Two duplicates were also prepared without Chelex to determine the total activity of the ^{109}Cd-isotope added to each sample. The entire procedure was performed in a cooling room (∼8 °C), and the tubes were incubated on a mixer (Heidolph, Swabach, Germany) between each step. After centrifugation (12 000g, 5 min, 4 °C), the supernatant (900 μL) was transferred to new tubes and the activity of ^{109}Cd was determined using a gamma counter (Cobra II Auto-Gamma, Packard Instruments Company, Dowers Grove, IL). Hepatic MT levels were calculated using eq 1, where CPM_s is counts per minute activity in the sample, CPM_{Bg} is counts per minute activity in the blank and CPM_T is the counts per minute activity in the total sample without Chelex. A concentration of 263 nmol/mL Cd was added to the samples. Multiplication by $^1/_7$ refers to 7 binding sites of Cd on MT; multiplication by 10 refers to dilution of the tissue homogenate, whereas multiplication by 1.49 refers to the dilution factor of the assay.

$$\mathrm{MT(nmol/g\ wet\ weight)} = \frac{CPM_S - CPM_{Bg}}{CPM_T} \cdot 263\mathrm{nmol/mL} \cdot \frac{1}{7} \cdot 10 \cdot 1.49 \quad (1)$$

Determination of the Chemical Elements in Muscle Tissue. Approximately 1 g muscle tissue (filet) was weighed and transferred to PTFE-Teflon vials (18 mL). Subsequently, 2.3 g ultrapure water (Q-option, Elga Labwater, Veolia Water Systems LTD, UK) and 4.2 g concentrated nitric acid, HNO_3 (Scanpure, equal to ultrapure grade, Chemscan, Elverum, Norway) were added to the vials. Digestion of these portions was carried out in a high-pressure microwave system (Milestone UltraClave, EMLS, Leutkirch, Germany) according to a temperature profile which increases gradually from room temperature up to 250 within 1 h. In addition there was a cooling step which allowed temperature to return back to the initial value within ca. 1 h. After cooling to room temperature, the digested samples were diluted with ultrapure water to 60 mL in polypropylene vials to achieve a final HNO_3 concentration of 0.6 M. High resolution inductively coupled plasma mass spectrometry (HR-ICP-MS) analyses were performed using a Thermo Finnigan model Element 2 instrument (Bremen, Germany). The radio frequency power was set to

1400 W. The samples were introduced using a SC-FAST flow injection analysis system (ESI, Elemental Scientific, Inc. Omaha, NE) with a peristaltic pump (1 mL/min). The instrument was equipped with a PFA-ST nebulizer, spray chamber (PFA Barrel 35 mm), demountable torch, quarts standard injector as well as Al sample skimmer and X-skimmer cones. The nebulizer argon gas flow rate was adjusted to give a stable signal with maximum intensity for the nuclides lithium (^{7}Li), indium (^{115}In) and uranium (^{238}U). Methane gas was used in the analysis to minimize interferences from carbon and to provide enhanced sensitivity, especially for Se and As. The instrument was calibrated using 0.6 HNO_3 solutions of matrix-matched multielement standards.

A calibration curve consisting of five different concentrations was made from these standards. To check for the instrument drift, one of these multielement standards was analyzed every 10 samples. The accuracy of the method was verified by analyzing the certified reference material Oyster Tissue NIST 1566b (National Institute of Standards and Technology, Gaithersburg, MD). The concentrations found were within 90−115% of the certified values for all trace elements. To assess possible contamination during sample preparation, blank samples of HNO_3 and ultrapure water were prepared using the same procedure as for the samples. Method detection limits (MDL) ranged from 0.01 μg/kg to 0.02 mg/kg for Au and Zn respectively (Table S1 in the Supporting Information (SI)). MDLs were calculated as follows: depending on which method resulted in higher values, the MDLs were either based on 3 times the standard deviation of the blanks, or on the instrument detection limits (IDL). The IDLs were estimated from the subsequent analysis of solutions, containing decreasing, low concentrations of the element. Finally, the concentration resulting in a relative standard deviation of approximately 25% (n = 3 scans) were selected as IDL with baseline corrections applied for these values.

Statistical Analysis. Orthogonal partial least-squares (OPLS) regression, using SIMCA P+ (version 12.0.0.0) (Umetrics, Umeå, Sweden), was used to model the effect of metal and element concentrations on biological variables (e.g., MT levels) in the trout. OPLS is a statistical tool that has been designed to deal with multiple regression problems where the number of observations are limited and the correlation between the predictor variables are high (multicolinearity). The OPLS method is a modification of the partial least-squares (PLS) method.[28] OPLS separate the systematic variation in X into two parts, one that is linearly related (and therefore predictive) to Y and one that is orthogonal to Y. This partitioning of the X-data provides improved transparency and interpretability compared to conventional PLS. For each OPLS model, a R^2 (R^2Y) and a Q^2 value were calculated, where R^2 shows the dispersion of the data from the model and Q^2 shows the cross-validation of the model. R^2 value > 0.7 and a Q^2 value >0.4 denote a highly significant model when analyzing biological data.[29] Variable importance in projection (VIP) coefficients reflects the relative importance of each X variable in the prediction model. VIP allows classifying the X-variables according to their explanatory power of Y. The coefficient plot summaries the relationships between the Y variable and the X variables. Default jack-knifed confidence intervals in the coefficient plot combined with the VIP plot identify important and significant variables in the model. Predictors with large VIP, larger than 1, are the most relevant for explaining Y. For significance testing the OPLS prediction, ANOVA of the cross-validated residuals (CV-ANOVA) was applied.[30] For further statistical analysis, simple and multiple linear regression analyses were also preformed, using SPSS (version 15; SPSS). Multiple linear regression was performed in the default Enter method, and data were diagnosed for multicolinearity according the software description. Data were log-transformed to achieve normal distribution. The significance level was set to $p < 0.05$ for all tests.

Table 1. Muscle Metal and Element Muscle Tissue Concentrations (Wet Weight) in Brown Trout (*Salmo trutta*) from Lake Mjøsa, Norway

	mean ± SD	median	min−max
Hg (mg/kg)	0.67 ± 0.27	0.64	0.33−1.88
Se (mg/kg)	0.23 ± 0.04	0.24	0.17−0.35
Fe (mg/kg)	3.29 ± 1.36	3.01	1.76−8.02
Zn (mg/kg)	3.76 ± 8.84	3.43	2.97−6.85
Cu (mg/kg)	0.35 ± 0.11	0.34	0.20−0.68
Al (mg/kg)	0.07 ± 0.60	0.05	0.01−0.26
As (mg/kg)	0.05 ± 0.03	0.03	0.02−0.16
Mn (mg/kg)	0.06 ± 0.02	0.06	0.04−0.13
Co (μg/kg)	2.75 ± 1.10	2.50	0.80−6.70
Ni (μg/kg)	1.70 ± 1.05	1.35	0.78−5.60
Pb (μg/kg)	0.37 ± 0.22	0.29	0.16−1.10
Cd (μg/kg)	0.28 ± 0.15	0.27	0.12−0.97
Au (μg/kg)	0.03 ± 0.02	0.03	0.01−0.11

RESULTS

Concentrations of metals and elements in muscle tissues of trout from Mjøsa are listed in Table 1. Nonessential metals were dominated by Hg, followed by Al and As, whereas essential metals and elements were dominated by Fe and Zn, followed by Cu, Se, and Mn. Levels of Cd and Pb in muscle tissues were low. Hg concentrations ranged from 0.33 to 1.81 mg/kg wet weight (median 0.64 mg/kg). Se:Hg molar ratios ranged from 0.49 to 1.88 (mean 1.01, median 0.92), implying that 50% of the trout in the present study had Se:Hg molar ratios <1. Hepatic MT levels of the trout ranged from 33.80 to 85.70 nmol/g wet weight (mean ± SD; 43.17 ± 9.88, median 41.50 nmol/g wet weight).

Accumulation of Metals and MT in Relation to Fish Size. Fish size (body length) ranged from 52 to 89 cm (mean ± SD: 67.7 ± 8.5 cm, median: 67.5 cm). Applying fish size as the dependent variable (Y) and concentrations of metals and elements, the Se:Hg molar ratio and MT levels as the predictor values (Xs) resulted in a significant OPLS model (one component, $R^2X = 0.233$, $R^2Y = 0.489$, $Q^2 = 0.362$, CV-ANOVA $p < 0.0001$), showing that several of the metals and elements, and MT, were associated with fish size. The highest VIP (the importance of the variable in the OPLS projection) value was shown by Hg, followed by the Se:Hg molar ratio, Cd, Co, MT and Fe (see Figure S1 in the SI). Concentrations of Hg, Cd, MT and Fe increased, while the Se:Hg molar ratio and concentrations Co decreased with fish size (see Figure S2 in the SI). Further testing (simple linear regressions) also showed Hg ($R^2 = 0.44$, $F_{1,32} = 25.26$, $p < 0.0001$), and to lesser extents Cd ($R^2 = 0.18$, $F_{1,32} = 7.10$, $p = 0.012$), and MT ($R^2 = 0.10$, $F_{1,31} = 3.25$, $p = 0.081$) to correlate positively with fish size. The Se:Hg molar ratio ($R^2 = 0.37$, $F_{1,32} = 19.12$, $p < 0.0001$), and to lesser extent Co ($R^2 = 0.14$, $F_{1,32} = 5.31$, $p = 0.028$) correlated inversely with fish size.

Effect of Metals on MT Induction. Applying MT as Y, and concentrations of metals, the Se:Hg molar ratio and fish size as

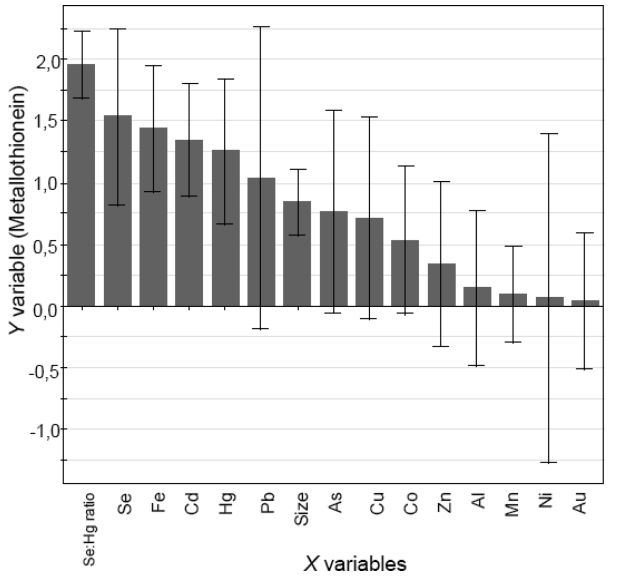

Figure 1. Orthogonal partial least-square (PLS) regression variable of importance plot (VIP) reflecting the relative importance of metal levels, tissue Se:Hg molar ratio and body size (*X* variables) on affecting hepatic metallothionein levels (*Y* variable) in brown trout, *Salmo trutta*, from Lake Mjøsa, Norway.

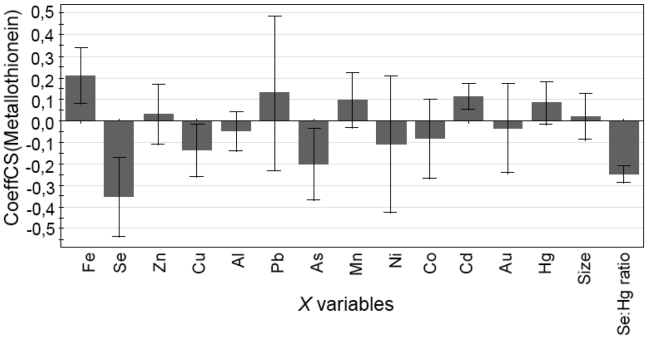

Figure 2. Orthogonal partial least-square (OPLS) regression coefficient plot summarizing the relationship between metal levels, tissue Se:Hg molar ratio and body size (*X* variables) on hepatic metallothionein (MT) levels (*Y* variable) in brown trout, *Salmo trutta*, from Lake Mjøsa, Norway. Negative coefficients reflect inverse relationships, whereas positive coefficients reflect positive relationships, of the different *X* variables with MT levels.

Xs, resulted in a highly significant OPLS model (one component, $R^2X = 0.379$, $R^2Y = 0.739$, $Q^2 = 0.511$, CV-ANOVA $p < 0.0001$), showing that several of the metals were associated with MT levels in the trout. The highest VIP value was shown by the Se:Hg molar ratio (VIP > 1.5) followed by Se, Fe, Cd, Hg, and Pb (VIP > 1) (Figure 1). The coefficient plot showed that the Se:Hg molar ratio and Se were inversely associated with hepatic MT levels. In contrast, Hg, Cd, and Fe were positively correlated with MT levels in the trout (Figure 2).

Simple regression analyses also showed that the Se:Hg molar ratio was the strongest predictor of MT levels in the trout (Figure 3, $R^2 = 0.49$, $F_{1,31} = 29.75$, $p < 0.0001$). MT levels were also inversely associated with Se ($R^2 = 0.29$, $F_{1,31} = 12.94$, $p = 0.001$), and positively associated with Fe ($R^2 = 0.26$, $F_{1,31} = 11.11$, $p = 0.002$), Cd ($R^2 = 0.23$, $F_{1,31} = 9.20$, $p = 0.005$), Hg

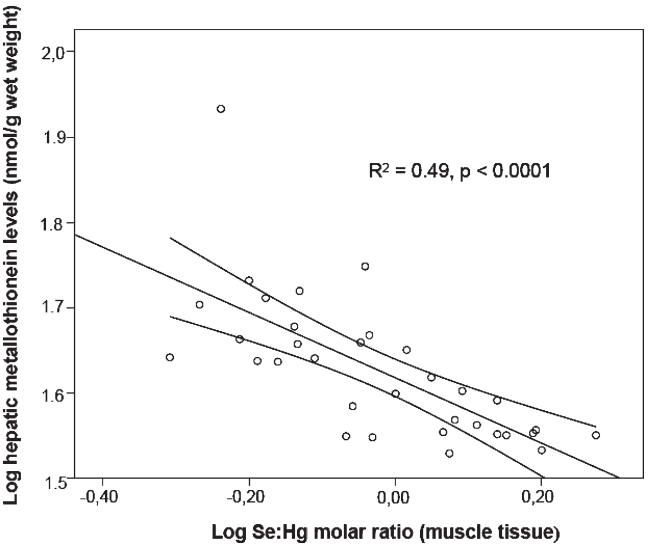

Figure 3. Inverse relationship (±95% coefficient interval) between hepatic metallothionein (MT) levels and muscle tissue Se:Hg molar ratio in brown trout, *Salmo trutta*, from Lake Mjøsa, Norway.

($R^2 = 0.22$, $F_{1,31} = 7.77$, $p = 0.009$), and to lesser extent with Pb ($R^2 = 0.14$, $F_{1,31} = 5.10$, $p = 0.031$). Further testing, using multiple linear regression and uploading the best predictors from the OPLS model (i.e., the Se:Hg molar ratio, Se, Fe, Cd, Hg, Pb) as independent predictors, gave a significant prediction of MT levels in the trout ($R^2 = 0.68$, $F_{5,27} = 11.51$, $p < 0.0001$). In this regression analysis, MT levels were inversely associated with Se ($t = -5.25$, $p < 0.0001$) and positively associated with Hg ($t = 3.31$, $p = 0.003$), but not associated with Cd, Pb, and Fe. The Se:Hg molar ratio was excluded from this analysis by the SPSS software due to its multicolinearity with Hg. A second multiple linear regression analysis was therefore executed with the Se:Hg molar ratio replacing Hg. This gave an equally significant prediction as the above ($R^2 = 0.68$, $F_{5,27} = 11.51$, $p < 0.0001$). In this second analysis, MT levels were inversely associated with both Se ($t = -3.34$, $p = 0.002$) and the Se:Hg molar ratio ($t = -3.31$, $p = 0.003$), whereas Cd, Pb, Fe as above explained no variation in the MT levels.

DISCUSSION

Increased MT induction following Hg exposure has been observed in several fish studies.[7,31] Although our results indicate a good correlation between Hg and MT induction in trout from Lake Mjøsa, the results also demonstrates that Se significantly reduces the demands for MT following Hg exposure in free-ranging fish. This is supported by the fact that the tissue Se:Hg molar ratio and the tissue Se concentrations were the best statistical predictors of MT levels in the trout. The statistical models showed that Hg in molar excess of Se was a stronger inducer of MT synthesis than tissue Hg levels and other potential MT inducers (e.g., Fe and Cd) in the trout of the present study. This supports the assumption that Se has a prominent protective effect on the toxicity of Hg.[3,4,32,33] The molecular mechanisms responsible for the interaction between Se and Hg remains incompletely defined. However, the most comprehensive hypothesis involves the formation of biologically inert and stable Se−Hg complexes.[3,4] This protecting effect of Se on Hg toxicity is most likely due to the Hg to Se binding affinity are approximately

10^6 greater than Hg−S.[34] This suggests that Se is superior to sulfur containing molecules (e.g., MT and glutathione) in scavenging Hg. Thus, we suggest it is first when the Se ability of sequestering Hg is exhausted that there is a pronounced Hg-dependent induction in the synthesis of MT.

Recent research suggests an alternative interpretation of the consequences of the Se and Hg interaction or formation of Se−Hg complexes.[34] This hypothesis suggests that the protective properties of Se against Hg toxicity are achieved by hindering the loss of Se-dependent enzyme activities occurring as a consequence of Hg-dependent sequestration of Se.[4,33,34] Thus, intracellular Hg diminishes the amount of Se that is biologically available for normal selenoprotein synthesis. Selenoenzymes, such as glutathione peroxidases, thioredoxin reductases, and iodothyronine deiodinases have important biological functions in antioxidant defense, redox signaling, thyroid hormone metabolism, and immune responses.[35] Indeed, as a constituent of selenoproteins derived from selenocysteine and selenomethionine, Se has been described as the most important antioxidant element in the body, and Se deficiency has been linked to cancer and neurodegenerative diseases.[36] Because selenoenzyme activities are compromised by Hg and MeHg exposure, Se in sufficient molar excesses over Hg will maintain the enzyme activities of antioxidant systems and prevent the oxidative damage that otherwise accompanies Hg toxicity.[4] The inverse association between MT levels and the Se:Hg molar ratio in the present study may therefore relate to increased demands of MT for scavenging reactive oxygen species caused by a perturbed function of the antioxidant apparatus caused by Hg-contamination in the trout.

The importance of the molar ratio in Se-dependent protection against MeHg toxicity has been shown in other studies.[4,32,33] For instance, no toxic effects were reported in rats fed a high-MeHg/high-Se diet, whereas adverse toxic effects were observed in rats fed a high-MeHg/low-Se diet and a high-MeHg/normal-Se diet.[4,33] In that particular study, toxicity was not predicted by tissue Hg, but was inversely related to tissue Se and the Se:Hg molar ratios in the rats. These authors were the first to provide data in support of the hypothesis that Hg-dependent sequestration of Se is the primary mechanisms of Hg toxicity and that the Se:Hg molar ratio provide a more reliable and comprehensive criteria for evaluating risks associated with MeHg exposure. Se also interact with toxic metals other than Hg such as Cd,[37] suggesting that Hg sequestration of Se may also increase toxic potentials of these metals in the trout. We propose that the results presented herein suggests that Hg-dependent sequestration of Se also could be a mechanisms of Hg toxicity in free-ranging fish, and that the Se:Hg molar ratio should be applied when evaluating risks associated with MeHg exposure in wildlife.

The trout in the present study showed a relatively narrow range in the Se:Hg molar ratio, around a 1:1 stoichiometry of the ratio, where approximately 50% of trout had Se:Hg molar ratios <1. Despite this, Se:Hg molar ratios showed a strong inverse relationship with MT levels (Figure 3). This suggests that a molar excess of Hg just slightly over Se is sufficient to induce MT synthesis trout. Our present study support a Se:Hg molar ratio ≈1 as a threshold for the protective action of Se against Hg toxicity. This is probably because Se:Hg molar ratios below or approaching the 1:1 stoichiometry reflect physiological states where Se is insufficient to alleviate Hg toxicity. Alternatively, reflecting states where the bioavailability of Se is sufficiently reduced by Hg to perturb normal Se-dependent functions. Se-sequestration by Hg raises the concern that Hg toxicity could occur at more or less any level of Hg exposure, provided a concurrent low molar Se level in the animal. This implies that detrimental effects following Hg exposure in wildlife may occur at lower Hg exposure levels than currently recognized. This is of great concern, and warrants further investigations. But, this also suggests that supplemental Se treatment would alleviate the Hg toxicity problem. Indeed, in Sweden whole lakes have been treated with Se to combat Hg toxicity.[38]

The Hg concentrations in the present trout from Lake Mjøsa (0.67 ± 0.27 mg/kg wet weight, Table 1), were about 50% of the concentrations reported in Lake Mjøsa trout in 1980.[17] Hence, there has been a large decline in Hg levels in Lake Mjøsa during the last three decades. Based on average Hg (1.29 ± 0.44 mg/kg) and Se (0.25 ± 0.04 mg/kg wet weight) concentrations reported in Lake Mjøsa trout back in 1980,[17] the average Se:Hg molar ratio in Lake Mjøsa trout sampled then were as low as 0.5 (for comparison the average Se:Hg molar ratio in trout sampled 2008 is our present study was 1.01). This suggests that trout in Lake Mjøsa actually coped with substantially lower Se:Hg molar ratios than those reported in present study. We suggest that this is due to the compensating role of MT when the Se:Hg ratio is below 1. This demonstrates the protective role of MT when Hg is present in higher concentrations than Se in the organism. It is likely that the decreased Hg toxicity encountered by the trout is a significant factor in the reported catch increases in Lake Mjøsa since the 1970s and 1980s,[39] when Hg exposure peaked in the lake.

Hg was positively associated with the size of the trout in the present study. The positive relationship between Hg levels and fish size is consistent with the high bioaccumulating potential of Hg, causing levels to increase with trophic level and age of the fish [14] (both of which increase with body size in trout). There was no relationship between Se and size. This resulted in an inverse relationship between the Se:Hg molar ratio and fish size. Furthermore, there was a tendency toward a positive relationship between MT levels and size. This suggests a greater toxic risk of Hg-dependent toxicity in the larger sized trout in Se-depauperate lakes (see Figures S1 and S2 in the SI). Since the 1970s and 1980s, when the levels of Hg in Lake Mjøsa peaked, the proportion of trout with body length >60 cm have increased gradually and substantially.[39] Also the catch per unit (time) effort needed to catch trout >60 cm have decreased substantially during this period.[39] This may indicate that low Se:Hg molar ratios constitutes a limiting factor that adversely affect the ability of trout to reach large body sizes due to that highly polluted Hg individuals suffered from Hg toxicity.

■ ASSOCIATED CONTENT

Supporting Information. Table S1: Detection limits of metals and elements calculated from instrumental detection limits (IDLs) in brown trout from Lake Mjøsa, Norway. Figures S1 and S2: Relationships between metal and element levels, and metallothionein with fish-size in the brown trout from Lake Mjøsa, Norway. This material is available free of charge via the Internet at http://pubs.acs.org.

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■ ACKNOWLEDGMENT

This work is funded in part by the Research Council of Norway (Environment 2015 Programme, project 183923/S30) and the Norwegian Climate and Pollution Agency (project 5009124). Appreciation is expressed to Per Harald Olsen and Professor Ole Kristian Berg, Norwegian University of Science and Technology (NTNU), and Morten Kraabøl, Norwegian Institute for Nature Research (NINA), for assistance with planning and conducting the field work. We also thank local fishermen for providing fish to the study.

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Dr Robert N. Crittenden

Regarding Dredging, sluicing, and panning

Dredging, panning, and sluicing not only improve salmonid habitat but can also create new habitat.

Salmonid eggs and alevins (alevins are tiny newly hatched salmonids which still reside in the interstitial spaces among the gravel of the streambed) need clean gravels through; which interstitial water can flow, providing them with oxygen. Silts and fine sands reduce the porosity of the streambed, thereby, reducing the interstitial flow and the oxygen supply. It can also reduce the amount of interstitial space for alevins. Reduced porosity has been shown to be directly related to reduced survival of salmonid eggs and alevins.

If properly conducted (for example, according to the present guidelines in Washington State — WDW 1987) dredging, panning, and sluicing reduce the amount of fine sand and silt in the streambed and, thereby, improve its porosity. These activities will, therefore, result in better interstitial flow, a better interstitial oxygen supply for eggs and alevins, and more interstitial space for alevins. The net result is improved survival for salmonid eggs and alevins.

Thus, dredging, panning, and sluicing improve existing salmonid habitat and can also create new habitat. These activities should be encouraged.

Habitat for salmonid eggs and alevins — the importance of streambed porosity:

Pink Salmon: As William R. Heard pointed out in his (1991) review "Pink salmon choose a fairly uniform spawning bed in both Asia and North America. Generally these spawning beds are situated on riffles with clean gravel or along the borders between pools and riffles in shallow water with moderate to fast currents. . . . pink salmon avoid spawning in quiet deep water, in pools, in areas with a slow current, or over heavily silted or mud-covered streambeds."

Pink salmon *(Oncorhynchus gorbuscha)* spawning sites may be characterized as being clean gravels. However these sites may also have a few cobbles, a mixture of sand, but relatively little silt (Semko 1954; Kobayashi 1968; Dvinin 1952; Smirnov 1975; and Hunter 1959).

The faster the current, the larger the particle which will be suspended and carried off by it. Hence, a strong current provides some guarantee that silts and fine sands will not plug up the interstitial spaces. The more rapid flow is also turbulent. The eggs and alevins are provided with a good oxygen supply by the turbulent mixing of water into the interstices of the streambed.

The porosity of a streambed and the survival of eggs and alevins has been demonstrated to be directly related to the composition of the streambed, being lower where there are more fine sands and silt (McNeil and Ahnell 1964; Rukhlov 1969; Brannon 1965; Bams 1969).

Chum **Salmon:** In contrast, to pink salmon which preferentially select riffles, chum salmon *(Oncorhynchus ketd)* tend to select sites of upwelling spring water (Kobayashi 1968). These sites often have a lower flow rate than is found at pink salmon sites (Bams 1982; Soin 1954; Sano and Nagasawa 1958). Chum salmon spawning sites may be found directly below a pool which is partially obstructed at its lower end by a gravel bar. The water infiltrates the gravel bar, travels through the bar as ground water, and reemerges into the water column below the bar.

Interstitial flow is as important for the survival of their eggs and alevins, as it is for the pink salmon. However, in this case the oxygen is carried into the groundwater by convection (that is by the net movement of water into and then out of the streambed) rather than by turbulent mixing. However, in some cases turbulent mixing may also be an important factor at chum spawning sites.

Sockeye Salmon: Sockeye salmon *(Oncorhynchus nerka)* spawn either in streams or in areas along lake shores which have underwater springs. There is also a case of beach spawning where turbulence provides the oxygen supply (Olsen 1968). Spring-fed and Beach spawning sites often have lower oxygen levels than stream sites and sockeye eggs have some ecological and physiological adaptations which improve their survival under those slightly reduced oxygen levels. (Smirnov 1950; Soin 1956, 1964). However, their oxygen supply (and, hence, substrate porosity) remain an important factor affecting their survival.

Coho Salmon: Coho salmon *(Oncorhynchus kisutch)* mostly spawn in small steams in areas of gravel of 15 cm or less in diameter (Burner 1951). In some cases Burner found that the spawning sites contained mud, silt, or fine sand, but that this was removed in the nest-building activity. Chamberlain (1907) concluded that coho are the least selective of the salmon species about their spawning site — he found them spawning in almost every stream or river in a very broad range of sites from smoothly flowing to white water and from cobble to muddy His conclusion was also supported by Foerster (1935) and Pritchard (1940).

However coho appear to prefer small streams (Gribanov 1948) and select a site at the head of a riffle where there is a good interstitial flow (Shapovalov and Taft 1954). The porosity of the streambed and the flowrate of the stream are also important factors affecting site selection (Briggs 1953; Gribanov 1948). Survival has been shown to be related to the porosity of the streambed (Tagart 1984).

King Salmon: King Salmon *(Oncorhynchus Tshawytscha)* show strong selectivity for spawning areas with high interstitial flow rates (Vronskiy 1972; Russell et al. 1983). Mike Healey (1991) suggests that of all the salmon species, king salmon may be the most sensitive to reduced oxygen levels during the egg and alevin stages. Their sensitivity to the oxygen level was experimentally demonstrated by Silver et al. (1963). The strong relationship between survival and the percolation rate of oxygenated interstitial water was experimentally demonstrated by Shelton (1955) and demonstrated under field conditions by Gangmark and Broad (1955) and Gangmark and Bakkala (1960).

As Mike Healey (1991) points out, "There is no doubt that percolation is affected by siltation and that siltation in spawning beds causes high mortality (Shaw and Maga 1943; Wickett 1954; Shelton and Pollock 1966).

Caveats: Bear in mind that spawning habitat limitation may not be the mechanism limiting the abundance of any specific stock of salmon. There is an absence of support for the habitat limitation hypothesis, except in a few isolated cases. Nevertheless, the enhancement of habitat and the improvement of survival for eggs and alevins are generally desirable goals.

Also bear in mind that in areas which have no fish, restrictions on dredging, sluicing, or panning aren't needed. An example of such as area is the region of a watershed above an impassible barrier, whether it is a dam, waterfall, or rapid.

In areas which have fish, recreational mining activities should be restricted to times of the year such that eggs and alevins aren't buried under silt and fine sediment while they are still in the gravel. Such regulations are already in place in Washington State.

Effects of dredging, sluicing, and panning on the porosity of the streambed:

Generally these activities involve the removal of sediment material from the streambed or, more often, from a gravel bar. The fine components of the sediment become suspended in the wash water and are carried downstream. The finer the sediment the further it will be carried. However, it will eventually settle, often in a quiet pool area.

What is involved here is the movement of the smaller particles out of a riffle area and into a pool area. Generally this will improve the streambed porosity in the riffle area. Recall that riffles are generally the preferred spawning habitat.

Medium sized particles may deposit in the riffle area. During the next major peak-flow event both the fine sediments and the medium sized particles will often be carried far downstream.

Thus, the effect of mining is to increase the downstream transport rate for fine and medium sediments. The consequence must be that the stream-system as a whole will have fewer of these sediments. This will result in greater streambed porosity. As the literature I have reviewed above shows, for all salmonid species greater porosity results in better survival and more available habitat for eggs and alevins.

In the case where the sediment is removed from a bar, rather than from the streambed, it is necessary to consider a longer time period — Stream courses aren't stationary but move within the confines of the streambanks. Fine sediments in gravel bars will be resuspended in the stream during these natural movements of the stream over the course of several years.

However, if the bars have been mined on a regular basis, their fine and medium particles will already have been removed before the river naturally resuspends them. Gravel bars which are free of silts and fine sand provide habitat. Although these bars may appear dry, there is often water and interstitial spaces below the surface, which can support alevins and redds (that is, nests of eggs) which were laid during high-water.

Recommendation:

The conclusion is that the recreational mining activities of panning, sluicing, and dredging enhance salmonid habitat. These activities should be encouraged. They provide one of the most cost-effective enhancement techniques as they are a beneficial side-effect of private recreation.

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Sincerely

Dr. Robert N. Crittenden
March 2, 1996

PAGE #1. HOUSE COMMITTEE ENERGY AN ENVIRONMENT MAY 3. 2017

CHAIRMAN Representative Helm **AND MEMBERS OF THE COMMITTEE: THANK YOU FOR HEARING MY TESTIMONY AND VIEWING MY EXHIBITS.**

TOM QUINTAL OREGON RESIDENT 76 YEARS SMALL SCALE MINER FOR 30 YEARS I PARTICIPATED IN THE ONE YEAR OREGON STATE PARKS SCENIC WATERS STUDY GROUP AND SB838 6 MONTH GOVERNORS STUDY GROUP TO INCLUDE MANY DEQ, DSL, MEETINGS INCLUDING USFS AND BLM ROADLESS STUDY PROPOSALS. I HAVE FOR 20 YRS PARTICIPATED IN OREGONS CITIZENS LEGISLATIVE PROCESS.

OREGON MINERS WOULD APPRECIAT A NO VOTE ON SB-3A

February 16, 1962. JOHN F. KENNEDY ISSUED AN Executive Order 10997 ASSINGING EMERGENCY PREPAREDNESS FUNCTIONS TO THE SECRETARY OF THE INTERIOR

FOR US NATIONAL SECURITY.

CURRENTLY THE US imports 90% of our strategic minerals from China.
Most of the US strategic minerals are located this side of the Rocky Mountains.
SHUTTING DOWN MINING DOES NOT SEEM TO BE A WISE DECISION.
RURAL OREGON WILL LOSE ABOUT 30 MILION ANNUALLY.

SB 3 with the -8 amendments repeals the suction dredge mining moratorium AND replaces it with permanent suction dredge mining BAN IN ESH waters, effective on January 1, 2018. WILL ELIMINATE ABOUT 80%OF OREGON MINERALIZED STREAMS TO PRODUCTIVE MINING. DEQ's NEW EPA APPROVED LIST FOR 303D STREAMS WILL ELIMINATE UP TO 90% OF OREGON MINERALIZED STREAMS TO SUCTION DREDGE MINING. OREGON SCENICE WATERS INCLUDES 33 STREAMS THAT DOES NOT ALLOW MOTORIZED MINING, SO THERE IS NOT MUCH LEFT FOR OREGON MINERS TO DO PRODUCTIVE MINING WITH SUCTION DREDGE EQUIPMENT.

OREGON MINERS ARE WAITING FOR AN OPINION FROM THE 9TH CIRCUIT COURT FOR THE REPEAL OF OREGON'S BAN ON MOTORIZED MINING TO PREVENT A TAKINGS OF FEDERAL MINING CLAIM MINERAL PROPERTY.

I REFER YOU TO (OLS) FOR STUDIES SHOWING MOTORIZED MINING IS NOT HARMFUL TO SALMON, LAMPEY FRESH WATER CLAMS AND MOLLUSKS. THERE IS AN EXCELLENT RECENT STUDY SHOWING NATURAL SELENIUM IN STREAMS ABSORBS METHYL MERCURY.

REGARDING DEQ PERMITS PLEASE SEE RETIRED REPRESENTATIVE GORDON ANDERSON LETTER TO DEQ. HE WAS VERY DISAPPOINTED WITH DEQ AND THEIR LACK OF CONSULTATION REQUIRED IN ORS 517.125 FOR THE 2005 SUCTION DREDGE PERMIT AND HOW DEQ RENEGED ON THE BARGIN MINERS

MADE WITH DEQ FOR NO TURBIDITY AND REPORTING REQUIREMENTS FOR EQUIPMENT UNDER 4 INCH SUCTION NOZZLES IF MINERS WOULD NOT RESIST DEQ TO INTRODUCE LEGISLATION TO START CHARGING A PERMIT FEE OF $25.00 ANNUALLY.

"BUILDING A BIGGER BURACURACY."

THE CURRENT DEQ 15 PAGE PERMIT WAS BROUGHT ABOUT BY A SECRET DEAL DEQ MADE WITH THE ENVIRONMENTALIS IF THEY WOULD DROP THEIR LAWSUIT AGAINST DEQ'S SUCTION DREDGE PERMIT AND THEY WERE PAID $7,500 FOR THEIR LEGAL COST. THAT SETTLEMENT ALLOWED ENVIRONMENTALIST TO REQUIRE EXCESSIVE RESTRICTIONS INCLUDING FISH MAPPING, GPS LOCATION REQUIREMENTS ETC.
OREGON MINERS WERE NOT CONSULTED ON THE NEW PERMIT RESTRICTIONS.

DEQ IN 2016 ONLY SOLD 156 SUCTION DREDGE PERMITS. DOWN FROM 1900 PERMITS IN YEARS EARLIER. BECAUSE OF SB-3A REQUIRING SIGNIFICANT FEE INCREASE, DEQ ANTICIPATES A 70% DROP IN THE NUMBER OF INDIVIDUALS PARTICIPATING IN SUCTION DREDGE MINING.. AS A RESULT THE NET REVENUE IMPACT TO DEQ FOR THE 2017-19 BIENNIUM IS ESTIMATED TO BE $19,600 AND $27,450 FOR THE 2019-21 BIENNIUM. AS A RESULT OF SB-3A DEQ HAS INDICATED THAT TO ENSURE PROPER PERMIT OVERSIGHT, AN ADDITIONAL POSITION (1.00 FTE) WOULD BE REQUIRED. THE NEW POSITION WOULD BE A NATURAL RESOURCE SPECIALIST 2 COSTING $238,150 PER BIENNIA. GIVEN THE SMALL AMOUNT OF OTHER FUNDS REVENUE GENERATED BY THE $250.00 FEE, IT IS ASSUMED MOST OF THE COST WOULD HAVE TO BE PAID BY THE GENERAL FUND. WITH A 70% REDUCTION OF PERMIT SALES THIS COST SEEMS EXCESSIVE AND NEEDS AUDITING.

OREGON LEGISLATIVE ENVINONMENTAL BILLS AND STATE AGENCIES REGULATIONS.FORCE MINERS TO GIVE UP THEIR FEDERAL MINING RIGHTS AND ENVIROMENTALMIST AND SPECIAL INTEREST STREAM USERS JUST KEEP USING THE SAME FOLKS TO TAKE MORE MINING RIGHTS AWAY AND NEVER GIVE ANYTHING UP TO MINERS.
MINERS RESPECTFULLY REQUEST YOU TO VOTE NO AND OPPOSE SB-3 BEFORE YOU MOVE THIS BILL ANY FURTHER.

I HAVE A FEW PICTURES YOU MIGHT BE INTERESTED IN.

THANK YOU FOR TAKING MY TESTIMONY,

TOM QUINTAL

1718 SONYA DR. SE SALEM, OREGON 97317

PHOTO SHOWS SMALL TURBIDITY FROM A 4 INCH DREDG. DEQ PERMITS ALLOW 300 FT. TURBIDITY.