Greene Environmental Services
33180 Dorset Lane
Philomath, Oregon, USA 97370-9555

February 22, 2013

Subject: **House Bill 3251, Follow up to Committee Testimony**

Dear Representative Whitsett,

I commented during my testimony, in answer to your question, that the effects of driving a vehicle through the Chetco River would be less-than-significant. I explained that driving through the river would have a somewhat more limited impact than small-scale gold suction dredging which was just declared to have effects to the environment that are less than significant.

I have included information, in bullet format, that empirically demonstrates that all of the anti-suction dredge mining furor you are seeing and hearing is a solution looking for a problem and by extension so is driving through the Chetco River.

The information I have supplied is data taken from the $1.2 million dollar California Department of Fish and Game Subsequent Environmental Impact Report (2012) and numerous environmental scientific studies. The consensus of all this scientific literature is that the act of performing small-scale gold suction dredging has a **Less-than-Significant** impact on the environment. http://www.dfg.ca.gov/suctiondredge/

If this information is not sufficient to answer your question please allow me to further explain my position.

Sincerely,

Joseph C. Greene

Joseph C. Greene

Research Biologist
U.S. EPA (Retired)

(1). Bullets Regarding the Environmental Impacts of Small-scale Gold Suction Dredging

I. The Effects of Small-Scale Suction Dredging on Fish, Fish Eggs, and Sensitive Early Life Stages

No effects because Small-scale suction dredges are not allowed to operate in Oregon streams and rivers for about 9-months out of each year, to protect spawning salmonids, fish redds, and early life stages. **Less-than-significant**

II. The effects of suction dredging on invertebrates

Fish and invertebrates were not highly sensitive to dredging in general (Harvey, B.C., 1986). **Less-than-significant.**

III. Stream Bed Movement and Habitat Disturbances from Small-Scale Suction Dredging

Cross-sectional profiles indicated that the impact of the dredge piles relative to the stream width of the river is small. Operation of multiple dredges do not result in cumulative effects. Gravels are dispersed by the high stream flows, which included dredge tailings, compose a portion of the suitable spawning gravels each year. **Less-than-significant.**

IV. Turbidity, Siltation, Sediment Effects from Small-Scale Suction Dredging

Water quality is typically temporally and spatially restricted to the time and immediate vicinity of the dredge. Sediment rates from suction dredging are only a minor fraction of natural rates in mountainous streams. Inter-gravel permeability is not significantly changed by dredging. **Less-than-significant.**

V. The Effect of Small-Scale Suction Dredging on Water Chemistry

Water quality is impacted only during the actual operation of the suction dredge, which was generally 2 to 4 hours of actual operation. The primary effects of suction dredging on water chemistry could be increased turbidity, total filterable solids, and copper and zinc concentrations downstream of the dredge. These variables will return to upstream levels within 50- 100 downstream of the dredge. **Less-than-significant.**

VI. Recreation

A California DF&G Viewer Response survey to Suction Dredging Activities at the Suction Dredge Site were not negative. Also, there were no Safety Hazards to Dredgers and Others from Suction Dredge Operations, Equipment, and/or Geomorphic Changes. **Less-than-significant.**

VII. *Economy*

Greater than $18 million dollars will be lost from Oregon economy if the small-scale gold suction dredging industry is destroyed. **Significant and unavoiadable**

VIII. Small-Scale Dredging Efficiency and Rates

Studies to date have not shown any actual effect on the environment by suction dredging, except for those that are short-term and localized in nature (USACE, 1994). **Less-than-significant.**

(2). Results from the California Department of Fish & Game $1.5 Million Dollar Subsequent Environmental Impact Report that Support Information in the Bullets

IX. The Effects of Small-Scale Suction Dredging on Fish, Fish Eggs, and Sensitive Early Life Stages

(Small-scale suction dredges are not allowed to operate in Oregon streams and rivers for about 9-months out of each year, to protect spawning salmonids and fish redds and early life stages of the same).

1) ***Direct Effects on Spawning Fish and their Habitat (Less than Significant).*** Small-scale suction dredging does not occur during spawning season or when sensitive early life stages are present (California Final Subsequent Environmental Impact Report, March 2012);
2) ***Direct Entrainment, Displacement or Burial of Eggs, Larvae and Mollusks (Less than Significant).*** Small-scale suction dredging does not occur during spawning season or when sensitive early life stages are present (California Final Subsequent Environmental Impact Report, March 2012);
3) ***Effects on Early Life Stage Development (Less than Significant).*** Small-scale suction dredging does not occur during spawning season or when sensitive early life stages are present (California Final Subsequent Environmental Impact Report, March 2012).

X. The effects of suction dredging on invertebrates

1) ***Effects on the Benthic Community/Prey Base (Less than Significant)*** (California Final Subsequent Environmental Impact Report, March 2012);
2) ***A Fundamental Change to the Structure of a Community or Stream Ecosystem, Including Substantial Reductions in Biodiversity or Resiliency to Disturbance (Less than Significant)*** (California Final Subsequent Environmental Impact Report, March 2012).

XI. Stream Bed Movement and Habitat Disturbances from Small-Scale Suction Dredging

1) ***Creation and Alteration of Pools and other Thermal Refugia (Less than Significant)*** (California Final Subsequent Environmental Impact Report, March 2012).

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;

2) ***Destabilization/Removal of In-stream Habitat Elements (e.g., Coarse Woody Debris, Boulders, Riffles) (Less than Significant)*** (California Final Subsequent Environmental Impact Report, March 2012)*;*
3) ***Destabilization of the Stream bank (Less than Significant)*** (California Final Subsequent Environmental Impact Report, March 2012)*;*
4) ***Effects on Habitat and Flow Rates Through Dewatering, Damming or Diversions (Less than Significant)*** (California Final Subsequent Environmental Impact Report, March 2012);
5) ***Effects on Federal and State Protected Wetlands (Less than Significant).*** (California Final Subsequent Environmental Impact Report, March 2012);
6) ***Direct Disturbance to Riparian and Aquatic Habitats, and Other Sensitive Natural Communities (Less than Significant).*** (California Final Subsequent Environmental Impact Report, March 2012);
7) ***Destabilization of Channel Bed Forms such as Riffle and Bars (Less than Significant)*** (California Final Subsequent Environmental Impact Report, March 2012)*;*
8) ***Destabilization of Channel Profile (Less than Significant)*** (California Final Subsequent Environmental Impact Report, March 2012)*;*
9) ***Stream flow Channelization, Diversion, or Obstruction (Less than Significant)*** (California Final Subsequent Environmental Impact Report, March 2012)*;*
10) ***Alteration or Destabilization of Lake Bed or Shoreline (Less than Significant)*** (California Final Subsequent Environmental Impact Report, March 2012).

XII. Turbidity, Siltation, Sediment Effects from Small-Scale Suction Dredging

1) ***Effects of Turbidity/TSS Discharges from Suction Dredging (Less than Significant)*** (California Final Subsequent Environmental Impact Report, March 2012)*;*
2) ***Erosion, Transport, and Deposition of Alluvial Material in Rivers and Streams Resulting in Dredge Potholes, Tailings Piles, and Other Suspension/Depositional Features (Less than Significant)*** (California Final Subsequent Environmental Impact Report, March 2012).

XIII. The Effect of Small-Scale Suction Dredging on Water Chemistry

1) ***Effects of Contaminant Discharges from Dredge Site Development and Use (Less than Significant)*** (California Final Subsequent Environmental Impact Report, March 2012)***;***
2) ***Effects of Contaminant Discharges of Oil or Gasoline Used in Suction Dredges (Less than Significant)*** (California Final Subsequent Environmental Impact Report, March 2012)***;***
3) ***Effects of Trace Organic Compounds Discharged from Suction Dredging (Less than Significant)*** (California Final Subsequent Environmental Impact Report, March 2012)***;***
4) ***Use, Handling, Storage, Transport, Disposal and/or Accidental Release of Oil or Gasoline Used in Suction Dredges (Less than Significant)*** (California Final Subsequent Environmental Impact Report, March 2012)***;***
5) ***Use, Handling, Storage, Transport, Disposal, and/or Accidental Release of Materials Used to Process Suction Dredge Concentrates (Less than Significant)*** (California Final Subsequent Environmental Impact Report, March 2012).

XIV. Recreation

1) ***Viewer Response to Suction Dredging Activities at the Suction Dredge Site (Less than Significant)*** (California Final Subsequent Environmental Impact Report, March 2012)***;***
2) ***Safety Hazards to Dredgers and Others from Suction Dredge Operations, Equipment, and/or Geomorphic Changes (Less than Significant)*** (California Final Subsequent Environmental Impact Report, March 2012)***;***
3) ***Temporary Degradation of Visual Character from Turbidity Plumes Generated by Suction Dredging (Less than Significant)*** (California Final Subsequent Environmental Impact Report, March 2012)***;***
4) ***Alteration of Visual Character or Quality, or Scenic Resources, Following Completion of Suction Dredging Activities (Less than Significant)*** (California Final Subsequent Environmental Impact Report, March 2012)***;***
5) ***Alteration of Visual Character or Quality from Upland Activities Related to Suction Dredging (Less than Significant)*** (California Final Subsequent Environmental Impact Report, March 2012)***;***
6) ***Effects on the Quality of Recreational Resources or Experience (Less than Significant)*** (California Final Subsequent Environmental Impact Report, March 2012)***.d***

XV. *Economy (Greater than $18 million dollars lost)*

The following is some of the data regarding economics of small scale suction dredging taken from a California Department of Fish and Wildlife report. I have taken the information from a survey of potential economic damage caused to the mining community in California if the industry of small-scale gold suction dredging is destroyed. I recalculated the data to reflect removing the 1200 miners, that would be 1115 Oregon miners and 85 California miners, that have purchased permits to work in Oregon Rivers and streams.

- 1200 suction dredge permit holders would spend approximately **$10,760,400** for groceries, restaurants, camp fees and other living expenses;
- 1200 suction dredge permit holders would spend approximately **$5,164,800** on gas, oil, equipment maintenance and repairs;
- 1200 suction dredge permit holders would spend approximately **$2,582,400** on suction dredge and related equipment every 4-years; and,
- The State of Oregon collected **$30,000** in dredge permit fees.

These activities represent approximately **$18,537,600** lost to the Oregon economy if the small-scale gold suction dredging industry is destroyed. These calculations are based on information collected in California for the year 2008 so the loss of jobs and capital in 2012 would be somewhat larger.

(3). Comprehensive List of Scientific Publications that Support Information in the Bullets

A Review of Research Results that Involved the Use of Gold Suction Dredges

Compiled by: Joseph C. Greene
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May 4, 2005
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I. The Effects of Small-Scale Suction Dredging on Fish, Fish Eggs, and Sensitive Early Life Stages

(Although small-sacale suction dredges are not allowed to operate in Oregon streams and rivers for about 9-months out of each year, to protect spawning salmonoids and fish redds, this section was included so the record would be complete)

1) Because of the short mining season, fry emergence and rearing did not appear to be impacted to a high degree by dredging (Hassler, T.J., W.L. Somer and G.R. Stern, 1986);
2) Adult fish were not likely to be affected or likely to be sucked into dredges (Harvey, B.C., 1986);
3) Fish and invertebrates were not highly sensitive to dredging in general (Harvey, B.C., 1986);
4) At the level of activity observed, anadromous salmonids and habitat were only moderately affected (Hassler, T.J., W.L. Somer and G.R. Stern, 1986);
5) Fish congregate and feed where dredging displaces and exposes benthic invertebrates (Hassler, T.J., W.L. Somer and G.R. Stern, 1986);
6) Cumulative suction dredge mining was found to be non-significant for each of the three response variables tested in a general linear model (Response variables were pool densities of salmonids over one-year-old, pool densities of young-of-the-year salmonids, and a stream habitat measure of width-to-depth ratio) (Bayley, P.B., 2004 Draft); Un-eyed cutthroat trout eggs experienced 100% mortality within 1 hour after entrainment (Griffith, J.S. and D.A. Andrews, 1981);
7) Juveniles used dredge holes, and their feeding, growth, and production did not seem to be impacted (Hassler, T.J., W.L. Somer and G.R. Stern, 1986);

8) Dace, suckers, juvenile steelhead and salmon fed, rested and held in dredge holes (Hassler, T.J., W.L. Somer and G.R. Stern, 1986);

9) Impacts on fish and habitat were moderate, seasonal and site-specific (Hassler, T.J., W.L. Somer and G.R. Stern, 1986);

10) Fish appeared and began to feed as soon as dredging started (Lewis, R., 1962);

11) A 5-inch dredge could improve the inter-gravel environment for both fish eggs and benthos (Lewis, R., 1962);

12) Fish in Canyon Creek sought out dredge plumes to feed on exposed invertebrates (Stern, G.R., 1988);

13) Steelhead fed opportunistically (Hassler, T.J., W.L. Somer and G.R. Stern, 1986);

14) Salmonids spawned in the vicinity of the previous seasons dredging, but salmonid redds were not located in the tailing piles (Hassler, T.J., W.L. Somer and G.R. Stern, 1986);

15) Scour of Chinook salmon redds located on dredge tailings exceeded scour of redds on natural substrates, although differences varied among streams California (Harvey, B.C. and T.E. Lisle, 1999);

16) The effects of suction dredging would appear to be less than significant and not deleterious to fish (CDFG, 1997);

17) The tank fish tests used sediment loads from 2 to 3-times as large as the extreme load contributed to the Rogue River by maximum conditions of hydraulic placer mining (Ward, H.B., 1938);

18) The thin intermittent layer of placer mining gritty sediment (<1/8 inch) seen along the Rogue River would not interfere with the oxygen supply to fish eggs (Ward, H.B., 1938);

19) The amount of colloidal fines in the Rogue River below placer mines is too small to adversely effect young eggs or fish food (Ward, H.B., 1938);

20) In tank tests young fish lived well up to 30-days in water mixed with natural soil materials (Ward, H.B., 1938);

21) Eyed cutthroat trout eggs showed means of 29% to 35% for 1-hour and 36-hour mortalities, respectively (Griffith, J.S. and D.A. Andrews, 1981);

22) The 19% mortality of eyed eggs of hatchery rainbow trout after 10-days was similar to that of the control group (Griffith, J.S. and D.A. Andrews, 1981);

23) Hatchery rainbow trout sac fry experienced 83% mortality after 20-days as compared to 9% for the controls. Yolk sacs were detached from approximately 40% of the fry during entrainment (Griffith, J.S. and D.A. Andrews, 1981);

24) Impacts to stream fish were severe for early life stages, eggs and sac fry, while free swimming fish were not directly affected (North, P.A., 1993);

25) The abundance of several species of aquatic insects and riffle sculpin were adversely affected, and the size of impact zone varied (Harvey, B.C., K. McCleneghan, J.D. Linn, and C.L. Langley, 1982); and,

26) Young salmon suffered no ill effects from heavy sediment loads ten times that found at Agness, OR from hydraulic mining (Ward, H.B., 1938);

II. The effects of suction dredging on invertebrates

1) Fish and invertebrates were not highly sensitive to dredging in general (Harvey, B.C., 1986);
2) Fewer than 1% of 3,623 invertebrates entrained showed injury or died within 24-hours. Most of the dead were mayflies that were undergoing emergence at the time of dredging (Griffith, J.S. and D.A. Andrews, 1981);
3) The total numbers of invertebrates that colonized samplers and their diversity indices did not differ significantly above and below dredges streams (Somer, W.L. and T.J. Hassler, 1992);
4) The 45-day re-colonization experiment indicates not only a rapid recovery in the total number of insects over time, but also that almost all taxa found on cobble substrates take part in the re-colonization of sand and gravel areas (Harvey, B.C., 1980);
5) Macroinvertebrate abundance was reduced 97% and the number of taxa by 88% immediately below the dredge. The abundance and diversity returned to values seen at the reference site by 50- 100 feet (80 to 160 meters) downstream of the dredge (Prussian, A.M., T.V. Royer, and G.W. Minshall, 1999);
6) In drift samples, numbers of gatherers were higher below than above dredging sites; numbers of other functional feeding groups were similar (Somer, W.L. and T.J. Hassler, 1992);
7) Most of the re-colonization of dredged plots by benthic invertebrates was completed after 38-days (Griffith, J.S. and D.A. Andrews, 1981);
8) Benthic communities were significantly altered, but alterations were localized and associated with changes in degree of embededness of cobbles and boulders (Harvey, B.C., 1986);
9) Downstream areas were not significantly affected (Thomas, V.G., 1985);
10) Invertebrates were displaced but re-colonized the disturbed site within the same season (North, P.A., 1993);
11) Habitat variables (water depth and velocity, organic matter, sediment) accounted for 17-75% of the variation observed in abundance of common taxa (Somer, W.L. and T.J. Hassler, 1992);
12) Numbers of invertebrates peaked earlier in samples below the dredges streams (Somer, W.L. and T.J. Hassler, 1992);
13) Shredders were more abundant above that below the dredges streams (Somer, W.L. and T.J. Hassler, 1992);
14) Filterers rapidly colonized samplers below the dredges and were later displaced by siltation in the streams (Somer, W.L. and T.J. Hassler, 1992);
15) Significant changes in aquatic insect abundance were restricted to the area dredged (Thomas, V.G., 1985);

16) Only 7.4% of benthic insects died from going through a dredge, although it varied by order (Lewis, R., 1962);
17) Re-colonization was substantially complete 1 month after dredging (Thomas, V.G., 1985);
18) Impacts of suction dredging on the bottom fauna appeared to be highly localized (Thomas, V.G., 1985);
19) The overall effect of dredging on the benthic community appears highly localized (Harvey, B.C., 1980);
20) Fish and invertebrates display considerable adaptability to dredging (Harvey, B.C., 1980);
21) Abundance and diversity of macroinvertebrates was greatly reduced in the first 6.2 feet (10 meters) below the dredge at Site 1, relative to the upstream reference site dredge (Prussian, A.M., T.V. Royer, and G.W. Minshall, 1999);
22) One year after dredging at both Site 1 and Site 2, recovery of macroinvertebrate diversity appeared to be substantial dredge (Prussian, A.M., T.V. Royer, and G.W. Minshall, 1999);
23) Results from Resurrection Creek indicated that there was no difference in the macroinvertebrate community between the mining area and the location downstream of the mining area, in terms of macroinvertebrate density, taxa richness, and EPT richness dredge (Prussian, A.M., T.V. Royer, and G.W. Minshall, 1999);
24) In general, these results are in agreement with other studies that have found only localized reductions in macroinvertebrate abundance in relation to recreational suction mining dredge (Prussian, A.M., T.V. Royer, and G.W. Minshall, 1999);
25) The abundance of several species of aquatic insects and riffle sculpin were adversely affected, and the size of impact zone varied (Harvey, B.C., K. McCleneghan, J.D. Linn, and C.L. Langley, 1982);
26) Effects on the benthic community are highly localized (Harvey, B.C., K. McCleneghan, J.D. Linn, and C.L. Langley, 1982);
27) The dredging did not significantly reduce the number of invertebrates (Hassler, T.J., W.L. Somer and G.R. Stern, 1986);
28) Impacts of dredging on invertebrates were minimal (Hassler, T.J., W.L. Somer and G.R. Stern, 1986); and,
29) All benthic insects settled back to the bottom within forty feet of the dredge (Lewis, R., 1962).

III. Stream Bed Movement and Habitat Disturbances from Small-Scale Suction Dredging

1) Flushing winter flows can greatly reduce the long term impact of dredging (Harvey, B.C., 1980);

2) Cross-sectional profiles indicated that the impact of the dredge piles relative to the stream width of the river was small. Dredge piles at Site 1 were largely obscure after 1-year following the scouring flows that accompany snow-melt. In Site 2 the dredge piles were clearly discernable after one year dredge (Prussian, A.M., T.V. Royer, and G.W. Minshall, 1999);
3) Where flushing flows occur, substrate changes are gone in one year (Harvey, B.C., K. McCleneghan, J.D. Linn, and C.L. Langley, 1982);
4) Changes in stream morphology was typically of short duration lasting until the next high flow (North, P.A., 1993);
5) High water flows and bed-load movement in winter filled dredge holes and flushed sediment from the study site streams (Somer, W.L. and T.J. Hassler, 1992);
6) Movement of unstable gravel beds downstream during the next year's peak flows filled the downstream pool (Thomas, V.G., 1985);
7) The effect of habitat disturbance are local and of short (North, P.A., 1993);
8) Effects were significant, but localized (Harvey, B.C., K. McCleneghan, J.D. Linn, and C.L. Langley, 1982);
9) Suction dredging effects could be short-lived on streams where high seasonal flows occur (Harvey, B.C., 1986);
10) Substrate changes were gone after one year (Harvey, B.C., 1986);
11) Operation of multiple dredges did not result in cumulative effects (Hassler, T.J., W.L. Somer and G.R. Stern, 1986);
12) Most visible effects were gone after one year (Hassler, T.J., W.L. Somer and G.R. Stern, 1986);
13) Salmonids spawned in the vicinity of the previous seasons dredging, but salmonid redds were not located in the tailing piles (Hassler, T.J., W.L. Somer and G.R. Stern, 1986); and,
14) Gravels dispersed by the high stream flows, which included dredge tailings, composed a portion of the suitable spawning gravels each year (Hassler, T.J., W.L. Somer and G.R. Stern, 1986).

IV. Turbidity, Siltation, Sediment Effects from Small-Scale Suction Dredging

1) The primary effects of suction dredging on water chemistry were increased turbidity, total filterable solids, and copper and zinc concentrations downstream of the dredge. These variables returned to upstream levels within 50- 100 feet (80- 160 meters) downstream of the dredge (Prussian, A.M., T.V. Royer, and G.W. Minshall, 1999);

2) No additive effects were detected on the Yuba River from 40 active dredges on a 6.8 mile (11 km) stretch (Harvey, B.C., K. McCleneghan, J.D. Linn, and C.L. Langley, 1982);
3) The area most impacted was from the dredge to about 98 feet (30 meters) downstream, for most turbidity and settleable solids (Harvey, B.C., K. McCleneghan, J.D. Linn, and C.L. Langley, 1982);
4) Six small dredges (<6 in.) on a 1.2 mile (2 km) stretch had no additive effect (Harvey, B.C., 1986);
5) Water quality was typically temporally and spatially restricted to the time and immediate vicinity of the dredge (North, P.A., 1993);
6) Greater variations in the natural stream chemistry have been observed in the region than have been observed in the dredge areas (Wanty, R.B., B. Wang and J. Vohden, 1997);
7) Sediment rates from suction dredging are only a minor fraction of natural rates in mountainous terrain (Badali, P.J., 1988);
8) Sedimentation rates fell back to ambient after 197 feet (60 meters) (Harvey, B.C., K. McCleneghan, J.D. Linn, and C.L. Langley, 1982);
9) The turbidity values found in the dredge studies fall within the range of turbidity values found for currently mined areas of the Fortymile River and many of its un-mined tributaries (Wanty, R.B., B. Wang and J. Vohden, 1997);
10) Inter-gravel permeability was not significantly changed by dredging (Thomas, V.G., 1985);
11) Siltation and organic matter fractions in samplers were higher below than above the dredges streams (Somer, W.L. and T.J. Hassler, 1992);
12) There was a relative intense, but localized, decline in water clarity during the time the dredge was operating dredge (Prussian, A.M., T.V. Royer, and G.W. Minshall, 1999);
13) Sedimentation rates were higher below than above the dredging sites streams (Somer, W.L. and T.J. Hassler, 1992);
14) Suspended sediment concentrations during dredging were highly variable (Thomas, V.G., 1985);
15) Suspended sediment discharge averaged a maximum of 340 mg/liter at the outflow and returned to background levels within 36 feet (11 meters) (Thomas, V.G., 1985);
16) No immediate downstream impacts were recorded other than fine sediment deposition (Thomas, V.G., 1985);
17) The turbidity plume was 200 feet long (Lewis, R., 1962);
18) Dredge plumes, although visible, were probably of little direct consequence to fish and invertebrates (Stern, G.R., 1988);
19) Maximum sediment concentrations were only a minute fraction of the great loads needed to impact fish feeding and respiration (Stern, G.R., 1988); and,
20) The amount of colloidal fines in the Rogue River below placer mines is too small to adversely affect young eggs or fish food (Ward, H.B., 1938).

V. The Effect of Small-Scale Suction Dredging on Water Chemistry

1) Water quality was impacted only during the actual operation of the suction dredge, which was generally 2 to 4 hours of actual operation (Hassler, T.J., W.L. Somer and G.R. Stern, 1986);
2) Suction dredging appears to have no measurable effect on the chemistry of the Fortymile River within this study area (Wanty, R.B., B. Wang and J. Vohden, 1997);
3) Greater variations in the natural stream chemistry have been observed in the region than have been observed in the dredge areas (Wanty, R.B., B. Wang and J. Vohden, 1997);
4) Site 1, dredge operation had no discernable effect on alkalinity, hardness, or specific conductance of water in the Fortymile River dredge (Prussian, A.M., T.V. Royer, and G.W. Minshall, 1999);
5) The primary effects of suction dredging on water chemistry were increased turbidity, total filterable solids, and copper and zinc concentrations downstream of the dredge. These variables returned to upstream levels within 50- 100 feet (80- 160 meters) downstream of the dredge (Prussian, A.M., T.V. Royer, and G.W. Minshall, 1999); and,
6) Dredge mining had little, if any, impact on water temperature (Hassler, T.J., W.L. Somer and G.R. Stern, 1986).

VIII. Small-Scale Dredging Efficiency and Rates

1) Studies to date have not shown any actual effect on the environment by suction dredging, except for those that are short-term and localized in nature (USACE, 1994);
2) This is an official recognition, by the U. S. Army Corps of Engineers, that below a certain size, the effects of suction dredging are so small and so short-term as to not warrant the regulations being imposed in many cases (USACE, 1994);
3) The U. S. Environmental Protection Agency, has ignored this concept, although numerous studies, including the EPA's own 1999 study of suction dredging, repeatedly and consistently support the Corps finding de minimus effects (USACE, 1994);
4) Four-inch and smaller dredges have inconsequential effects on aquatic resources (USACE, 1994);
5) Reports consistently find no actual impact of consequence on the environment, and so almost always fall back to the position that the ***potential*** for impact exists (USACE, 1994);T

6) he majority of dredge operations studied did not work long periods or disturb large areas of the streambed (Hassler, T.J., W.L. Somer and G.R. Stern, 1986);
7) Dredging improved permeability and velocity of water in gravel (Lewis, R., 1962);
8) The unmodified dredge moved about 2% of the manufacturer's maximum rating (Griffith, J.S. and D.A. Andrews, 1981);
9) Two hundred of the miners interview, only 57 spent more than 500 hours dredging per season (McCleneghan, K., and R.E. Johnson, 1983);
10) The average time spent dredging was 235 hours per season (McCleneghan, K., and R.E. Johnson, 1983);
11) No cumulative effects were indicated by the water sample data (Huber, C. and D. Blanchet, 1992);
12) Suction dredging and hand tool operations in the active stream channel caused no noticeable impact to water quality (Huber, C. and D. Blanchet, 1992);
13) There were no detectable water quality changes from numerous suction dredge operations located on the same creek (Huber, C. and D. Blanchet, 1992);
14) A 6-inch dredge is appropriate where substrate gravel size is large, but a large aperture may be disruptive in a small channel (Lewis, R., 1962);
15) Dredge holes and piles in the center of the stream are usually gone in one year (Stern, G.R., 1988);
16) Dredge piles along the bank of the creek may linger. This is similar to piles left by historic miners (Stern, G.R., 1988); and,
17) When done properly, legal dredging must be allowed by law and effects are acceptable (USDA, 1997).

List of Citations

Anonymous. 1997. Draft Environmental Impact Report Adoption of Amended Regulations for Suction Dredge Mining 1997. California Dept. Fish and Game. Sacramento, CA.

Badali, P.J., 1988. ***Effects of Suction Dredging on Fish and Benthic Invertebrates***. Recreational Dredging Seminar. Western Mining Council and State of Idaho Dept. of Water Resources.

Bayley, P.B., 2004. ***Response of fish to cumulative effects of suction dredge and hydraulic mining in the Illinois sub-basin, Siskiyou National Forest, Oregon***. Draft Manuscript. Dept Fisheries and Wildlife, Oregon State University, Corvallis, OR.

Griffith, J.S. and D.A. Andrews. 1981. ***The effects of small a suction dredge on the fishes and aquatic invertebrates in Idaho streams***. North American Journal of Fisheries Management 1:21-28.

Harvey, B.C. 1980. ***Effects of suction dredge mining on fish and invertebrates in California foothill streams***. Masters Thesis. University of California Davis.

Harvey, B.C., K. McCleneghan, J.D. Linn, and C.L. Langley. 1982. ***Some physical and biological effects of suction dredge mining***. Lab Report No. 82-3. California Department of Fish and Game. Sacramento, CA

Harvey, B.C. 1986. **Effects of suction gold dredging on fish and invertebrates in two California streams**. North American Journal of Fisheries Management, 6:401-409.

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.

Hassler, T.J., W.L. Somer and G.R. Stern. 1986. ***Impacts of suction dredge mining on anadromous fish, invertebrates and habitat in Canyon Creek, California***. U.S. Fish and Wildlife Service, California Cooperative Fishery Research Unit, Humbolt State University. Cooperative Agreement No. 14-16-0009-1547, Final Report. Arcata, CA.

Huber, C. and D. Blanchet. 1992. ***Water quality cumulative effects of placer mining on the Chugach National Forest, Kenai Peninsula, 1988-1990***. Chugach National Forest, U.S. Forest Service, Alaska Region, U.S. Department of Agriculture.

Lewis, R. 1962. ***Results of gold suction dredge investigation***, Memorandum of September 17, California Department of Fish and Game. Sacramento, CA.

McCleneghan, K., and R.E. Johnson. 1983. ***Suction dredge gold mining in the mother lode region of California***. Administrative Report 83-1. California Department of Fish and Game, Environmental Services Branch, Fish and Wildlife Water Pollution Control Laboratory, Rancho Cordova, CA.

North, P.A. 1993. ***A review of the regulations and literature regarding the environmental impacts of suction gold dredging***. U.S. Environmental Protection Agency, Region 10, Alaska Operations Office. EP 1.2: G 55/993.

Prussian, A.M., T.V. Royer, and G.W. Minshall. 1999. ***Impact of suction dredging on water quality, benthic habitat, and biota in the Fortymile River and Resurrection Creek, Alaska***. Prepared for: U. S. Environmental Protection Agency, Region 10, Seattle, WA.

Somer, W.L. and T.J. Hassler. 1992. ***Effects of suction-dredge gold mining on benthic invertebrates in a Northern California stream***. North American Journal of Fisheries Management 12:244-252.

Stern, G.R. 1988. ***Effects of suction dredge mining on anadromous salmonid habitat in Canyon Creek, Trinity County, California***. M.S. Thesis, Humbolt State University, Arcata, CA.

Thomas, V.G. 1985. ***Experimentally determined impacts of a small suction gold dredge on a Montana stream***. North American Journal of Fisheries Management 5:480-488.

U.S. Army Corps of Engineers. 1994 . ***Special Public Notice 94-10***. U.S. Army Corps of Engineers, SPN 9410, Sept. 13, 1994. Washington, D.C.

U.S. Department of Agriculture. 1997. ***Suction dredging in the national forests***. U.S. Department of Agriculture. Washington, D.C.

Wanty, R. B., B. Wang and J. Vohden. 1997. **Studies of suction dredge gold-placer mining operations along the Fortymile River, Eastern Alaska**. U. S. Geological Survey, M.S. 973, Denver Federal Center, Denver, CO. 80225.

Ward, H.B. 1938. ***Placer mining on the Rogue River, Oregon, in its relation to the fish and fishing in that stream***. Oregon Department of Geology and Mineral Industries, Bulletin 10. Salem, OR.