American Fisheries Society Oregon Chapter

OR Chapter AFS: PO Box 8062 Portland, OR 97207-8062 www.orafs.org

Date: February 2, 2016

To: The Honorable Chris Edwards, Senator
Committee Chair
Senate Committee on Environment and Natural Resources

RE: STATEMENT TO THE SENATE COMMITTEE ON ENVIRONMENT AND NATURAL RESOURCES OPPOSING SB 1530

Dear Senator Edwards,

The Oregon Chapter of the American Fisheries Society (ORAFS) is comprised of over 500 fisheries and aquatics science professionals from federal, state, and tribal agencies, colleges and universities, diverse private employers, college students, and retirees. ORAFS was established in 1964 as a chapter of the American Fisheries Society. Our mission is to improve the conservation and sustainability of Oregon fishery resources and their aquatic ecosystems for long-term public benefit by advancing science, education and public discourse concerning fisheries and aquatic science and by promoting the development of fisheries professionals.

During Oregon's 2013 legislative session, ORAFS introduced a white paper on the effects of suction dredge mining on Oregon fishes and aquatic habitats (attachment). We have also completed a supplemental paper on mercury, geomorphology, and fish/bivalve species impacts (attachment) as a companion document. As you address the challenging task of balancing the health of the state's aquatic systems with the other interests, we ask that you consider the peer-reviewed information that examines the potential impacts of suction dredge mining on fisheries and aquatic resources. Both the original white paper and the supplement are the product of considerable, scientific insight and process prepared by ORAFS members.

Based on our review of the literature, we find that there are potentially negative effects of suction dredge mining on stream morphology and spawning/reproductive success of some fish and freshwater mollusks. Suction dredge mining may also increase mercury impacts and may negatively affect rearing juvenile salmonids in their critical habitats. Given the negative impacts suction dredge mining has on our state's fishes and other aquatic resources, we support the continued moratorium of suction dredge mining as proposed by SB 1530.

Thank you for the opportunity to provide the enclosed information.

Respectfully,

Troy Brandt - President, ORAFS, 503-307-8367, president@orafs.org

Attachments:
Effects of suction dredge mining on Oregon fishes and aquatic habitats, Supplemental Information- ORAFS March 2015
Effects of suction dredge mining on Oregon fishes and aquatic habitats- ORAFS April 2013

EFFECTS OF SUCTION DREDGE MINING ON OREGON FISHES AND AQUATIC HABITATS

Oregon Chapter American Fisheries Society

April 2013

SUMMARY

The number of permit applications for suction dredge mining in Oregon has substantially increased due to shifting economic markets. Existing literature suggests that suction dredge mining, when properly managed and regulated, has localized and short-term impacts to fish and aquatic habitat. Maintaining these relatively low impacts, however, requires best management practices (BMP's) are followed and properly enforced. The literature shows that without enforceable BMP's in place, suction dredge mining can adversely alter physical habitats, food webs, behaviors, and physiology of sensitive fishes and other aquatic species (HWE 2011). In addition, continued disturbance of river substrates can mobilize toxic heavy metals, affecting not only aquatic food webs but humans as well (OAFS 2011). Little is understood regarding the impacts of increased and cumulative actions in Oregon streams. Most studies have focused on salmonid stocks of fish, overlooking impacts to other important non-game species such as lamprey and bivalves. Therefore, we recommend a precautionary approach to suction dredge mining in Oregon's waterways that is based on strengthening and enforcing BMP's. 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.

RISKS TO FISH FROM SUCTION DREDGE MINING

To date, the most complete literature review regarding impacts to fish and aquatic habitats from suction dredge mining was completed for the California Department of Fish and Wildlife Subsequent Environmental Impact Review (EIR; HWE 2011). Best management practices required by California suction dredge mining permits are similar to Oregon's, and provide a surrogate to evaluate the potential impacts in Oregon waters. This EIR found the impacts on fish from suction dredge mining in California to be less than significant, *as long as mitigation efforts specified in the permitting process were adhered to* (HWE 2011). By definition, 'less than significant' indicated a measureable impact, but not one likely to result in an adverse population-level effect on a particular species, or a widespread or long-lasting adverse effect on a natural community (HWE 2011).

However; other studies have documented lower survival, particularly at early life stages, for fish populations proximate to suction dredge mining activity. 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. Suction dredge mining can also cause direct mortality to eggs and early life stages of fishes (as well as bivalves) that are vulnerable to passing through a dredge.

RISKS TO AQUATIC HABITATS FROM SUCTION DREDGE MINING

Suction dredge mining can result in aquatic habitat alterations that include; substrate disturbance, increased fine sediment deposition, and increased turbidity all of which can have adverse impacts to fishes, bivalves and their habitats. In an assessment of suction dredge mining practices in the western United States, Harvey and Lisle (1998) reported, "effects of dredging commonly appear to be minor and local, but natural resource professionals should expect effects to vary widely among stream systems and reaches within systems". The resulting impacts are dependent on both the size and available spawning habitat of a river system (Harvey and Lisle 1999). We would expect impacts to be relatively greater in smaller systems with limited spawning habitat. In addition, impacts from suction dredge mining can be exacerbated in systems with flashy hydrology, which can experience multiple scour events each year. However, even in large streams, suction dredge mining has the potential to destabilize substrates on gravel bars and other habitat features important for native fishes and bivalves.

The size of the dredge compared with the stream is a good index to assess risks of specific suction dredge mining activities. In general, risks are highest on smaller streams where a larger proportion of the total streambed is disturbed. In larger rivers where a fraction of the stream bed is disturbed, juvenile and adult fishes may be able to avoid the localized impacts. However, if suction dredge mining occurs in habitats with high value for fish production, regardless of stream size, the impact could be substantial. For example, dredging disturbance is limited to less than 25 cubic yards per claim of wetted stream (a claim can occupy approximately 0.5 to 1.0 stream miles) in Essential Indigenous Salmonid Habitat (ESH). Typically, dredgers excavate 3 feet to reach bedrock, equating to a disturbed area of approximately 225 square feet. While this area could be a relatively small percentage of the overall length of stream used by fish, if the 225 square feet disturbed includes high value spawning gravels the actions could potentially result in lost production.

Assessing the impacts of suction dredge mining on aquatic habitats should not be limited only to permitted activities (e.g. Oregon DEQ 2010 and Oregon DSL 2011)**.** Although expressly prohibited in Oregon permits; boulders and large cobbles that are important for cover and streambed stability are sometimes removed from the streambed by suction dredge mining (Nawa 2002). Excavation of stream banks, also prohibited, has been documented to occur in salmonid spawning habitat in association with suction dredge mining activities (Nawa 2002). Several other prohibited actions have been documented in association with suction dredge mining including; removing in-stream large wood, constructing temporary dams, fuel storage directly adjacent to waterways, and removal of riparian vegetation (Nawa 2002). Together, these prohibited actions increase turbidity and sediment that may be harmful to fish by altering spawning and rearing habitats, or altering behavior. *Therefore, BMP's can only be a viable strategy to managing impacts from suction dredge mining if adequately enforced.*

HEAVY METAL TOXICITY AND SUCTION DREDGE MINING

The disturbance of stream substrates during suction dredge mining activities has the potential to mobilize toxic heavy metals, extending risks beyond the aquatic food web to humans. 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.

High concentrations of mercury can be found in streambed sediments, especially in areas with a history of intensive placer and cinnabar mining (e.g. upper Rogue River, Applegate River, Illinois River, northeastern Oregon, and tributaries to the South Umpqua River). Most mercury is buried at depths not normally disturbed during floods; however, *suction dredge mining can exhume this deeply buried mercury*. If not deposited in the dredge sluice box and removed by miners, this mercury is easily mobilized and made available to the food chain (Marvin-DiPasquale et al. 2011). In addition, despite efforts by dredgers to voluntarily retrieve mercury during the process, a significant amount of mercury can still be mobilized into waterways (Marvin-DiPasquale et al. 2011).

CONCLUSIONS AND RECOMMENDATIONS

We conclude that, when BMP's are followed, suction dredge mining can have localized and short-term impacts to fishes, bivalves and aquatic habitats. Even with BMP's, suction dredge mining activities can lower survival of eggs and early life stages of fishes that use tailings as spawning substrates, detrimentally alter substrates and river morphology, and mobilize toxic heavy metals. The level of impact is dependent on the size, productivity, and hydrology of the stream where dredging is permitted. Systems at highest risk are smaller, flashy, streams with limited spawning habitat and those inhabited by ESA-listed and other sensitive aquatic organisms. Aquatic habitat impacts are largely caused by activities prohibited under current permitting regulations. Thus, enforcement is a critical component to managing the potential impacts of suction dredge mining in Oregon waters.

Therefore, based on the review of the current science the Oregon Chapter of the American Fisheries Society recommends:

- Reviewing and strengthening current best management practices (e.g. Oregon DEQ 2010 and Oregon DSL 2011) to substantially reduce or eliminate impacts to fishes, bivalves and aquatic habitat. Elements of these BMP's for consideration may include:
    - Ensuring dredge tailings are not used by fishes and bivalves for spawning or during other sensitive life history stages.
    - Ensuring that permitted in-stream work periods are adequate to protect egg and larval stages of native fishes and bivalves.
- Prohibiting or greatly reducing suction dredge mining in areas used for spawning by sensitive fish stocks. These areas would be determined by local state and federal fish biologists, who would review dredge permits before they are issued.
- Adequately staffing the enforcement of practices required by suction dredge mining permits (e.g., removing mercury, leaving boulders and instream large wood in place, fueling away from streams, leaving riparian vegetation intact, etc.), particularly in areas of Essential Indigenous Salmonid Habitat (ESH).
- Reducing the uncertainty of impacts resulting from increased suction dredge mining activity in Oregon waters through monitoring and reporting of activities. Specifically, we recommend including:
    - An inventory of species presence in streams currently open to suction dredge mining.
    - A risk assessment of Oregon watersheds where suction dredge mining has the potential to mobilize toxic heavy metals already present or deposited by historical mining actions.
    - Annual reporting of stream area/volume disturbed by suction dredge mining in both ESH and non-ESH areas.
    - Developing methodologies for predicting biological impacts from multiple suction dredge mining operations in a single system.
    - Independent monitoring of a random sample of suction dredge mining claims throughout Oregon to evaluate localized impacts to fish and aquatic habitat.
    - Studying efficacy of smoothing suction dredge tailings as an effective mitigation technique for suction dredge mining in areas of fall-spawning fishes

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EFFECTS OF SUCTION DREDGE MINING ON OREGON FISHES AND AQUATIC HABITATS, SUPPLEMENTAL INFORMATION

OREGON CHAPTER AMERICAN FISHERIES SOCIETY
MARCH 2015

SUMMARY

Oregon Chapter of the American Fisheries Society (ORAFS) previously authored a 2013 white paper entitled, "Effects of Suction Dredge Mining on Oregon Fishes and Aquatic Habitats" that is available at www.orafs.org. In 2014, in accordance with Senate Bill 838 (passed in 2013), the Governor convened a study group to develop recommendations for a regulatory framework for suction dredge mining in Oregon. In addition to restricting suction dredge mining, SB 838 calls for a five year moratorium on suction dredge mining beginning in January 2016 unless a new regulatory framework is approved. Our intent in providing this supplemental information is to inform policy conversations that have the potential to lead to additional regulations.

This supplemental white paper reinforces the previous white paper's recommendations and provides additional details from our literature review and professional knowledge about specific effects from suction dredge mining as it relates to mercury, geomorphology, lamprey, and impacts to freshwater mussels and clams (bivalves). Our work on the original white paper and this supplemental paper has led us to make the following overall recommendations:

1. Review and strengthen current best management practices (BMP) (e.g. Oregon DEQ 2010 and Oregon DSL 2011) to substantially reduce or eliminate impacts to lamprey and other fish species, bivalves and aquatic habitat. BMP elements for consideration may include:
    - Monitor tailings from dredging operations to ensure they are not used by fish and bivalves for spawning or during other sensitive life history stages.
    - Update permitted in-stream work periods to protect all seasonal fish species spawn timings and enforce them to adequately protect egg and larval stages of fish and bivalves.
    - Inventory fish species presence in streams currently open to suction dredge mining. Mapping and monitoring locations of lamprey and bivalve presence for inclusion in areas to be avoided by suction dredge mining operations.

2. Prohibit suction dredge mining in areas used for spawning by sensitive fish stocks, particularly in areas of Essential Salmonid Habitat (ESH). These areas would be determined by biologists who would review dredge permits before they are issued.

3. Adequately enforce stipulations in suction dredge mining permits (e.g., removing mercury, leaving boulders and instream large wood in place, fueling away from streams, leaving riparian vegetation intact, etc.), particularly in ESH areas.

4. Reduce the uncertainty of impacts resulting from increased suction dredge mining activity in Oregon waters through monitoring and reporting of activities. Specifically, we recommend including:
    - A risk assessment of Oregon watersheds where suction dredge mining has the potential to mobilize toxic heavy metals already present or deposited by historical mining actions.
    - Annual reporting of stream area/volume disturbed by suction dredge mining in both ESH and non-ESH areas.
    - Developing methodologies for predicting biological impacts from multiple suction dredge mining operations in a single system.
    - Independent monitoring of a random sample of suction dredge mining claims throughout Oregon to evaluate localized impacts to fish and aquatic habitat.
    - Studying efficacy of smoothing suction dredge tailings as an effective mitigation technique for suction dredge mining in areas of spawning fishes.

MERCURY ACCUMULATION IN HABITAT AND IN FISHES

Legacy mercury occurs in many deep streambed sediments as a result of historical gold mining practices in Oregon. Mercury (Hg) and trace metals are remobilized from stream bed sediments during suction dredge mining and high banking practices (USFS 2015). The methylated form of mercury (MeHg) has the greatest potential to negatively impact fish and other aquatic or terrestrial species that eat fish (piscivorous). Methylmercury is passed up the food chain through adsorption by plankton and then by bio-accumulating in the tissues of organisms in higher concentrations at each successive trophic level. Fish metabolic processes are not effective at processing and eliminating methylmercury and at certain tissue concentrations, methylmercury negatively impacts behavior, health and reproductive success (USFS 2015). Bloom (1992) as cited by USEPA (1997) demonstrated that over 95 percent of mercury in fish tissue is in the methylated form and fish obtain greater than 90 percent of the methylmercury in their tissue from food (Sandheinrich and Wiener (2011)).

Rearing juvenile salmonids may be particularly vulnerable to increased methylmercury production as a result of suction dredge mining. Juvenile salmonids are known to utilize habitats such as lakes, sloughs, side channels, estuaries, beaver ponds, low-gradient tributaries to large rivers, and large areas of slack water. Marvin-DiPasquale et al. (2011) suggests that mercury contaminated fine sediments in the clay-silt sediment fraction may travel in the water column far downstream from source locations and settle in slow velocity areas. Such slow velocity areas include wetlands that also provide substrates rich in organic materials that are conducive to methylmercury production. Therefore, suction dredge mining related increases in methylmercury are most likely to be observed in wetlands and estuarine environments that are also known to be important rearing habitats for juvenile salmonids.

To summarize, piscivorous fish in the Rogue River basin already exhibit mercury tissue concentration levels that are known to cause deleterious effects to fish. Increased suction dredge mining will further increase the availability of methylated mercury to bioaccumulate in fish, and juvenile rearing salmonids may be particularly vulnerable because the habitats they utilize are conducive to methylated mercury production. It is likely that there are also negative impacts from mercury contamination to other non-salmonid fishes in the Rogue River, particularly those that are long-lived.

RISKS TO GEOMORPHOLOGY FROM SUCTION DREDGE MINING

Suction dredge mining is disproportionately concentrated in southwest Oregon. About 70 percent of the 748 ODEQ authorizations issued for suction dredge mining in 2014 were in two basins: the Rogue River (48 percent) and Umpqua River (22 percent). The sub-basins with the greatest numbers of authorizations were the Middle Rogue with 179 and the South Umpqua with 156 (E. Brawner, ODEQ, Pers. Comm. 2014 as cited in USFS 2015).

Harvey and Lisle (1998) describe that dredging activities near riffle crests can destabilize spawning areas and adjacent downstream stream reaches and suction dredge activities have the potential to decrease the depth of upstream pools by degrading riffle crests which control upstream water surface elevations (i.e., hydraulic control). Published studies document that effects of dredge tailing piles to channel morphology and bed composition are not long-lasting and are typically not visible the next year as a result of peak flows after the dredging season. However, Harvey et al. (1982), Thomas (1985) and Stern (1988) describe exceptions for sites not near the thalweg and where cobbles and boulders had been piled. Additionally, Thomas (1985) identified that gravel from dredging tailing piles can redistribute downstream from the original location and fill downstream pool habitat within a year. This relates back to how with the removal of substrate and disturbance of the stream bed, spawning areas, rearing, and holding areas are negatively impacted by dredging activities. These disturbances may impact the life history and biology of anadromous and resident fish, and change natural stream function in both short term and long term timeframes.

Dredging impacts also increase as dredging locations expand from single to multiple sites. The accumulation of impacts associated with dredging activities within a stream may result in cumulative effects that are greater than effects associated with a single suction dredge location. A difficulty in addressing this cumulative effects question is that the impact dredging footprint at an individual claim can vary dramatically. Typically a dredger burrows to bedrock and many holes are 3 feet deep, which along with the related tailings pile(s), can affect a large part of the active streambed, particularly in smaller streams. Streambed modifications can significantly modify the amount and quality of spawning and rearing habitat available. Additionally, modification and deposition of fine sediment may affect adjacent and downstream habitats. The length of stream impacted by suspended sediment can vary widely depending on the type of channel bed material at the dredging location. If channel bed material is coarse with few fines, sediment related impacts will be more localized as heavier mobilized sediments settle a short distance from the dredging site. Finer sediments including clay, silt, and sand remain suspended in the water column over long distances and have the potential to impact habitats at considerable distance from the mining site.

Concentrated dredging in specific stream reaches may have cumulative impacts to geomorphology including:

- Armoring of river bottoms from downstream redistribution of stream bed materials and fine sediment re-suspension and redistribution, including frequent and long-lasting unseasonal turbidity plumes. Increased fine sediments can negatively affect early life stage fish by decreasing circulation of oxygenated water through interstitial spaces in gravel, therefore decreasing egg to fry survival.
- Destabilization of stream bed spawning habitat and reduction in adjacent pool depths affects habitat quality, and in turn, is detrimental to spawning, holding, and rearing habitat availability and fish use. Habitat destruction causes the redistribution of juvenile and adult fish to less suitable habitats.
- Seasonal, short-term or long-term changes in stream bed sediment size, composition, and stability which can reduce macroinvertebrate fauna and stream productivity.

POTENTIAL IMPACTS TO LAMPREY AND FRESHWATER BIVALVES

Suction dredge mining has the potential to affect native freshwater bivalves and non-salmonid Oregon State Sensitive species including lamprey. Both lamprey and freshwater bivalves live for a portion of their life cycle in the stream bed and banks. Lamprey spawn in the spring and early summer (Moser et al. 2007, Luzier et al. 2011) in gravel at pool tailouts and riffles, creating nests for embryos. Juvenile (ammocoetes) rearing habitat is typically nearby associated spawning habitat (Moser et al. 2007). Lamprey embryos typically remain in the substrate for 19 days after spawning depending on water temperature. After hatching, ammocoetes burrow into the stream sediment and filter feed for between 2 and 7 years (USFWS 2012).

Freshwater bivalves spend their lives buried in sediment and as they mature the posterior end of the bivalve projects above the sediment surface during warm months, and retreats beneath the surface during colder months. Male bivalves will release gametes into the water column which are then drawn in by females to achieve internal fertilization of their eggs. Females then release larva (glochidia) into the water column, where they attach to fish and stay for days to months. The glochidia later release from the fish and burrow into the sediment. Release of glochidia varies by species and is triggered by environmental conditions and presence of host fish species (Nedeau et al. 2008).

Lamprey (embryos and ammocoetes) and bivalves (adults and glochidia) can be present in the stream bed during all times of the year. These species are at risk of direct mortality by being passed directly through a dredge, nesting destruction, and displacement and degradation of rearing habitats (HWE 2009). Overall impacts of suction dredge mining to rearing lamprey include direct mortality from being passed through a dredge, and indirect effects such as habitat disturbance which could lead to displacement and an increased chance of predation as well altered food availability. Since various lamprey life stages are present in the system for up to 7 years, continued disruption at the same habitat could have long lasting effects over time to generations of fish. Suction dredge mining is considered a threat to lamprey (USFWS 2012) and there is a need to develop guidance on suction dredge operations to protect ammocoetes (Luzier et al. 2011).

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