EFFECTS OF SUCTION DREDGE MINING ON OREGON FISHES AND AQUATIC HABITATS

Oregon Chapter American Fisheries Society

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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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