Workshop on the Freshwater Mussels of the Pacific Northwest

Wednesday, February 19, 2002
Vancouver Water Resources Center, Vancouver, WA

DRAFT Workshop Report

April 14th, 2003

Prepared by:

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1. Introduction

Freshwater mussels are found throughout the world and are most diverse in North America with approximately 300 native species. Of these, 72% are considered endangered, threatened, or of special concern (Williams et al 1993). This decline began in the late 1800s and has only been recognized within the past 30 years. Master (1990) noted that 55% of North America's mussels are extinct or imperiled, compared to only 7% of the continents bird and mammal species.

Freshwater mussels are an essential part of the ecosystem. Adults are consumed by terrestrial mammals such as muskrat and raccoon (Tyrell and Hornbach 1998) and were once a food resource for humans (Parmalee and Klippel 1974). Mussels improve water quality by filtering nutrients, suspended solids, and contaminants (Dewey 2000). They are used as an indicator species due to their sensitivity to habitat degradation and water quality (Imlay 1982, Havlik and Marking 1987, Turick 1988).

There are three genera of freshwater mussels native to the Pacific Northwest; Anodonta, Gonidea, and Margaritifera. Margaritifera is represented by one species, *M. falcata*, and is common to rivers and streams with cool flowing water. Anodonta is represented by five species, *A. beringiana*, *A. californiensis*, *A. kennerlyi*, *A. oregonensis*, and *A. wahlametensis* and are usually found in slower moving rivers or lakes. Finally, Gonidea is represented by one species, *G. angulata*, which is found in rivers.

A limited number of scattered investigations have provided information on the abundance and distribution of freshwater mussels in the Pacific Northwest. These studies have focused on identifying age structure, habitat requirements, and population viability. There is currently no coordinated monitoring program for freshwater mussels and there is no framework for understanding the biology of the species to serve monitoring and evaluation needs. This information is critical to all efforts to conserve and protect these species.

The United States Fish and Wildlife Service (USFWS) convened a workshop at the Vancouver Water Resources Center on February 19, 2003 to initiate discussion on the population status of freshwater mussels within the Pacific Northwest. The workshop was attended by 91 participants from federal, state, tribal, and academic institutions and agencies throughout the Pacific Northwest and was facilitated by Jen Stone and Howard Schaller of the USFWS, Columbia River Fisheries Program Office. The USFWS has established a website for the Freshwater Mussel Workshop at http://columbiariver.fws.gov/mussel.htm. The workshop agenda and other workshop documents are available from this website.

Specific objectives of the workshop were to:

- Gather experts in the area to share information and ideas related to freshwater mussels of the Pacific Northwest

- Assess the utility of forming a standing Technical Workgroup, and possible tasks for such a group

The first segment of the workshop consisted of a series of presentations summarizing:
1. Background on freshwater mussel biology and species distribution
2. Freshwater mussel habitat use
3. Causes of mussel mortality
3. Risk assessment-based monitoring strategy
4. Background on zebra mussels

The second segment of the workshop consisted of a panel discussion with topics focused on the development of a Technical Workgroup.

The purpose of this report is to provide a summary of the workshop presentations and discussions as well as future directions for addressing the issues and challenges associated with monitoring and evaluating the status of the freshwater mussels in the Pacific Northwest. The report is organized into the following sections:

1. Introduction
2. Brief summaries of each presentation and links to the associated MS Powerpoint presentation
3. Summary of Panel Discussion
4. Next Steps: Structure and function of proposed Technical Workgroup
5. Appendices: List of attendees, minutes of the panel discussion, and references

2 Summaries of Presentations

2.1 Background information on freshwater mussel biology and species distribution

2.1.1 *Pacific Northwest freshwater bivalves: life history and ecology*

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Summary: Unionid mussels are the large clams found in rivers and lakes in the Pacific Northwest. This group is very diverse with 300 species known across the United States. The most diversity is in the eastern U.S.; Illinois has 79 species of unionids and Alabama has 177. Washington and Oregon host 7 species of unionid clams. Unionids are filter feeders, obtaining food and oxygen from the flow of water past their shell. They have no siphon, so they can't burrow entirely into substrate. Adults can crawl short distances, especially to escape stimuli. They also can burrow vertically but at

distances less than their body length. Glochidia (larvae) are, however, very mobile. Reproduction is stimulated by change in water temperature. The female holds eggs in a specialized part of the gill, the marsupia. After fertilization by sperm broadcasted by the male, glochidia develop internally for a month to over a year, depending on the species. When glochidia are completely developed, some species simply broadcast them into the water. Others hold them in a wide range of structures that attract glochidial hosts. Some of these structures have a miraculous similarity to fish, worms, or other possible food items. When bitten, or simply approached by a potential host animal, glochidia are released. Those that attach to the gills burrow into the tissue. Only one species (in Africa) is not known to be parasitic. One North American species parasitizes an amphibian while all other North American species parasitize fish. Some are specific to one fish, others are generalists, but in most cases, hosts are not definitively known. Glochidia remain on the fish for a period of time ranging from hours to weeks, depending on species and water temperature. The relationship appears to be commensal, causing no ill effect to the fish unless the infestation is especially severe. While on the host, glochidia develop the structure of an adult bivalve. On leaving the host, they fall to the substrate and begin their adult existence. Foods are not well known, though algae, bacteria, and protozoans have been suggested. Some species may be highly specific. Adults frequently are found in aggregations or beds where water current and substrate type are appropriate for establishing a colony. Many species live as adults for decades, and some live as long as 140 years. Taxonomy of the unionids is not settled. Washington hosts four to seven species, depending on interpretation. Identification is also difficult. Trained personnel can identify shells of two local species in the field. The *Anodonta* are difficult to identify, even for an expert. The sum of this information is that both distribution and status of freshwater bivalves in the Pacific Northwest are not well known. Some current information is in error and we face many data gaps. Bivalves face numerous threats and even the presence of a living population does not mean the species is reproducing successfully. More information needs to be collected before we can ensure survival of these species. Once unionids get figured out, we can move on to the fingernail clams, another confusing group of 20-30 species in Washington and Oregon.

2.1.2 ***Some Recent and Historical Records for Northwestern U.S. Unionoids***

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Summary: Review of some 2,500 recently (1988-2002) collected freshwater mollusk sites in the western states of Washington, Oregon, Idaho, and northern California indicates that positives for larger freshwater bivalves (unionoids) are rare as compared to pleurocerids, physids, hydrobiids, and sphaeriids. Northwestern freshwater habitats differ in several important respects from those typical for the eastern and central US. Many northwestern freshwater forms are adapted for cold water oligotrophic habitats; and natural (as distinct from recently modified by humans) more eutrophic habitats are scattered and limited in extent. The western US freshwater gastropod malacofauna is only partly studied as yet, with major diversity increases having been made in the last 15 years and few detailed molecular phylogenetic hypotheses as yet available. While possibly less severe, the same problems plague elucidation of the bivalve fauna. Small ranges and common local endemism are characteristic of both terrestrial and freshwater gastropods and may be underestimated for freshwater mussels. Diversity of western larger bivalves is very limited but could double. Examination of type specimens and of our and the major US museum collections indicate about 10 well-accepted mussel species. It is likely, however, that several "species" are composite (*Anodonta californiensis*, *Anodonta oregonensis*). Consideration of the distribution and glochidial hosts of *Margaritinopsis falcata* strongly suggest that this taxon is composite also. Historic records for northwestern US unionoids are relatively numerous and promise that past distributions will be relatively robustly established. However, a consistent taxonomy and acceptance only of reposited and well-documented museum specimens (such as done by D. W. Taylor) will be required. As with northwestern freshwater gastropods, literature records are largely suspect. Gray literature reports, if documented by museum vouchers, may be very useful sources of recent data.

2.1.3 ***Historical distribution and taxonomy of freshwater mollusks of the western United States***

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Summary: The western states contain at least six endemic mussel species, and many endemic snail species. Records of western freshwater mollusks date from the mid-1800s, but there is a dearth of current information on the distribution and abundance of

western freshwater mollusks, in part because a comprehensive survey throughout their distributional ranges has not been done. There is also confusion regarding the taxonomic status of western species, and the exact number of valid species that occur in the region is not clear. Although several western states recognize that mollusk populations are declining, conservation and recovery efforts are hampered by the lack of basic information on western mollusk genetics, zoogeography, systematics and host fish. In addition, the conservation status for most western mollusks is unknown. The objectives of our work were to conduct a literature review to produce a database of all previously recognized western freshwater mollusk species and their historical distributions (and type localities where applicable), to produce a synonymy of western freshwater mollusks that includes all previously described western species, to compile a georeferenced distributional database for GIS coverage of all western mollusk mussels, and to recommend areas for further inventory and long-term monitoring. Data on western mollusks were complied from published literature, various museum collections and agency records. Data on historical occurrences, habitat, life history and other information were entered into a relational database. Distributional data were georeferenced, and special attention was given to nomenclature issues in order to determine whether some of the previously described western species deserve species-level status. To date, approximately 1,000 records of unionid mussels and 1,400 records of freshwater gastropods have been compiled from over 180 publications. There data were used to map the historical distribution of gastropods and bivalves in western regions, and to guide our directions for further inventories and research.

2.1.4 *Status of Nevada FRESHWATER MUSSEL management In Nevada*

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Summary: Nevada has two known orders of bivalves: the Unionoida and the Veneroida. Anecdotal information indicates there are two families in each of these orders: Margaritiferidae and Unionidae in the Unionoida family and Corbiculidae and Sphaeriidae in the Veneroida order. However, the GIS data that NDOW currently has in its database is for a few specimens of Anodonta (Unionidae) and numerous sightings of Sphaeriidae, mostly on the eastern side of Nevada. Location data is based on Scientific Collection Permit report data, and is limited to two collectors. Anecdotal information, based on discussions with NDOW field staff, indicates a much wider distribution and species richness than indicated by our current GIS database. As of 2000, NDOW now has a statewide coordinator for aquatic species, including fish, amphibians, shellfish, and various aquatic nuisance species. A program is being developed, including a section on shellfish. Staff is very limited and currently the coordinator is the only person working actively on shellfish, among other duties. However, progress is being made. A draft Nevada Bivalve Guide was generously

developed by Robert Howells, of the Texas Parks and Wildlife Department. In addition, a distribution map has been created from the Scientific Collection report data. Historic Scientific Collection Permits (SCP) have been catalogued to determine who has worked with bivalves in the past. A temporary employee has been hired to assist with the program. In 2003 NDOW will alert field staff to collect shells in the field and get GPS readings. These will be sent to the statewide coordinator in Reno. It is as yet undetermined who will provide identification assistance. We plan to conduct literature searches to increase our knowledge of current and historic distributions. Among the search methods will be: 1) library research 2) internet searches 3) contacting previous permit holders for whom we have no GIS data on record 4) letter to tribes, NGOs, other agencies, etc. to determine who might have data 5) interviews with identified key people who may be able to provide anecdotal data of shellfish locations, historic and current 6) contacting museums 7) contacts at professional meetings. The information collected will provide a basis for determining where presence/absence surveys would be most likely to produce positive results.

2.1.5 ***Washington State Unionid Mussel Distribution Database***

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Summary: The State of Washington has six known species of native freshwater or unionid mussels, representing three genera. Very little is known about the distribution or biology of these species, a poorly studied and often forgotten group of animals. The U.S. Fish and Wildlife Service has created a database to provide a depository for locality information for unionid mussels from the following genera: *Margaritinopsis (= Margaritifera)*, *Gonidea*, and *Anodonta*. We are also collecting locality information on the following nonnative genera: *Corbicula* and *Dreissena*, if available. Point information has been used to create a GIS layer of mussel locations in Washington. A freshwater mussel depository has been created by the Western Washington Fish and Wildlife Office for storage of voucher specimens until a suitable museum can be found. The synthesis and organization of this database will provide baseline information and improve our knowledge of the status and trends of unionid mussels in Washington. The database will also provide direction for future unionid survey work and zebra mussel risk assessments. I will present an overview of the database, as well as an update on the status of the project.

2.1.6 *Mussel Inventory of the Owyhee River, OR*

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Summary: In September 2002, Vale District BLM conducted a mollusk inventory of the Owyhee River through contract with Terry Frest (Deixis Consultants) in a preliminary effort to ascertain bivalve species composition and distribution within this Wild and Scenic River system. The Oregon segment of the Owyhee River was systematically sampled at 10 sites within 110 river miles. Only one mussel species, *Gonidea angulata*, was encountered, but shell fragments from prehistoric Indian middens on the river included *Margaritifera falcata* as well as *Gonidea*. Because *M. falcata* relies on salmon and probably trout for hosts, its apparent absence in the Owyhee could be related to extirpation of anadromous salmonids and the increase of unsuitable hosts such as exotic smallmouth bass. However, more surveys are needed to verify the status of *M. falcata* and other bivalves in the Owyhee River.

2.1.7 *Freshwater Mussel Distribution in Tarboo Creek*

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Summary: As part of the Tarboo watershed assessment, we are surveying mussel distribution and habitat types. Tarboo Creek is located at the northern end of Hood Canal in Washington State. The watershed is approximately 5,000 acres is size. The mainstem of Tarboo Creek is only about six miles long and flows through a wide valley of mixed pasture and forestlands before flowing into Tarboo Bay. Coho salmon, steelhead, chum salmon, searun and resident cutthroat, and a small run of Chinook salmon inhabit the creek. During the summer of 2002, we conducted snorkel surveys of a sub sample of streams throughout the watershed. We were primarily surveying for juvenile salmonids, but we also recorded our observations of mussels. We observed live mussels along most of the mainstem of Tarboo Creek. Mussels were most commonly observed in low gradient reaches (1-3 %) with stream substrate of sand and pea gravel, but rarely in larger substrates (gravel or cobble) or in sand substrate exclusively. Mussels occurred across a range of channel and riparian habitat conditions, from channelized stream reaches in pastureland to reaches with intact floodplain and second growth coniferous forest. Summer stream temperatures, as measured every 15 minutes at one-half mile intervals along the mainstem, were generally below 18 ^{o}C. The

Northwest Watershed Institute is considering conducting further survey and analysis work related to mussel distribution and habitat preferences that could be published as part of the full Tarboo watershed assessment due for completion in December of 2003.

2.2 Freshwater mussel habitat

2.2.1 *Association of a Rare Color Form of Margaritifera falcata with Stream Habitat Complexity*

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Summary: Sycan Marsh is located in the headwaters of the Upper Klamath Basin, an area with the some of the greatest aquatic animal diversity and endemism in the ecoregion. In a comprehensive survey of mussel populations in the Upper Sycan Watershed, one of only two known populations of *Margaritifera falcata* with salmon colored nacre was discovered in Long Creek, a tributary that enters Sycan Marsh from the west. In the Sycan River, a tributary from the east, *M.falcata* has the more typical purple nacre. The Long Creek population has purple nacre in barely 1 of 50 mussels, whereas in the Sycan River, the ratio is nearly reversed. Concurrent with mussel surveys in Long Creek, measurements were taken of the channel form, at the reach scale. Latitudinal transect surveys for mussels found that mussel densities varied with respect to stream channel characteristics. In low gradient streams, shallow, wide segments (which are considered a degraded habitat for trout) were also found to be poor habitat for *M.f*alcata. While young mussels (approx.<4 yr.) were often found in sand and silt deposits along margins and point bars of the stream, they were not found where there was erosion or large amounts of loose deposits. The largest, densest groups of older mussels were significantly associated with the deepest point in pools. A functional, low-gradient stream with good mussel habitat would therefore have a narrow, meandering channel, with deep pools and shallow riffles as well as point-bars efficient for deposition. Mussel transects and simple habitat measurements are a cheaper, easier and less invasive way to monitor habitat recovery beneficial to native salmonids than fish surveys. Methods that measure effective channel function and the presence of mussel beds could therefore be used as a way to document habitat recovery.

2.2.2 *Freshwater Mussel Bed Size, Density, and Population Age Structure in Upper Bear Creek, King County, Washington*

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Western pearlshell freshwater mussels (M. falcata) inhabit Bear Creek in King County, Washington. Washington Trout determined M. falcata bed size, density, and population age structure at a sub-sample of ten known freshwater mussel beds in upper Bear Creek. Stratified channel cross-sections and cross-channel positioning of live mussels were documented at each bed. Bed areas ranged from 37 m2 to 743 m2, with an average area of 153 m2. Live mussel densities ranged from 0.01 per m2 to 110 per m2. Mussels observed within the study sites ranged in age from an estimated 3 years to 124 years, based on a length-age regression. The results of this study provide a baseline against which future surveys of bed size, density, and population age structure can be compared to document changes in the health of the Bear Creek mussel population and commensurate changes in the biological integrity of the Bear Creek basin. Project partners include the Bear Creek Water Tenders, and King County Department of Natural Resources and Parks Water Land Resources Division. In 2003 the project will attempt to elucidate the factors affecting mortality rates of M. falcata in Bear Creek, and will include surveys targeting juvenile mussels (age 0 to 5 years).

2.2.3 *Distribution and habitat use of the Western pearlshell mussel in Cedar Creek, Washington*

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Summary: Distribution and physical habitat requirements of the freshwater mussel (*Margaritifera falcata*) were evaluated in Cedar Creek, a small tributary to the Lewis River, during 2000, 2001, and 2002. A stratified systematic design was used to sample mussels in a variety of habitat types throughout the basin. Thirty-one sites were evaluated and each site contained 12 sample quadrats where mussel density, ligament length, total length, and a variety of habitat measurements were recorded. *Margaritifera falcata* occurred throughout much of the lower section of Cedar Creek and were virtually absent in the mid and upper reaches. Variation in occurrence was low among sites and high within sites, with mussels present in 21 of the 31 reaches, but in only 52 of the 372 quads. The computed dispersal index (*I*) values for the reaches having quads containing mussels indicate that the mussels are distributed in a highly

contagious fashion, which is significantly different from a random pattern (X^2, P< 0.01). Associations between mussel density and stream habitat variables were examined using multiple stepwise regression. Percent small gravel, percent canopy, and conductivity were the most important predictors of mussel density. Preference curves were used to determine optimal ranges of water depth, water velocity, and surface substrate type. 18 cm and 49 cm depths were most heavily used relative to availability. Optimal ranges of 23-30 cm/sec velocities were observed. Overall, mussels preferred boulder dominated substrate nearly equal to small gravel and fine dominated substrate, although these types covered less than 20% of the sampled area. High maximum densities (>120 mussels/m2) were recorded in fine dominated substrates. By contrast, large gravel dominated substrates, which were far more common, (>45%) were under-used.

2.2.4 ***Freshwater Mussels in a California North Coast Range River: Occurrence, Distribution, and Controls***

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Summary: Rivers are dynamic environments, and long-lived species like mussels must develop strategies to deal with extreme physical conditions. We report the occurrence and habitat of mussel populations within a continuous 8-km section of the South Fork Eel River in the Northern Coast Range of California. The primary goals of our study were 1. to compile information on species composition and population density, and 2. to examine whether spatial distribution and variability were related to geomorphology and hydrology. High discharges almost certainly provide more of a constraint on the distribution and persistence of mussels in the South Fork Eel than do lower summer flows, so we used the Hydrologic Engineering Center's River Analysis System (HEC-RAS) hydraulic model to estimate physical conditions during high flows when in-channel investigations were not feasible. We found numerous individuals of two species (*Margaritifera falcata* and *Anodonta californiensis*), with the spatial distribution of both species characterized by high variability. Mussels in this system live almost exclusively in pools (with a few in runs), near the channel banks, and especially among sedge root-mat substrate. In all flow regimes (summer, winter, 5-y flood, and the largest floods on record), mussels were found in areas of lower boundary shear stresses and lower velocities. Our study suggests that, at various spatial scales, mussels appear to be distributed in a manner that protects them from the highest flow-induced stresses.

2.3 Mussel Mortality

2.3.1 *Effect of 2001 Drought on Two Mussel Species at the Sycan Marsh*

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Summary: The drought of 2001 was one of the severest on record in the Klamath Basin. The Nature Conservancy conducted a freshwater mussel survey in the summer of 2001 at their Sycan Marsh Preserve, in the headwaters of the Klamath Basin to monitor the effects of the drought. *Margaritifera falcata* (particularly the salmon color form) was found in higher gradient streams with a coarser substrate, cooler temperatures and a high groundwater component. *M.falcata* was not observed stressed or dying in any location. *Anodonta oregonensis* was estimated killed in over 50% of its range on the Preserve. *A.o.* was found in warmer, lower gradient streams and rivers with a fine substrate. Although stressed, *A.oregonensis* remained alive in small, isolated pools until many of those pools dried up in late August. The *A.o.* present in the larger waterways were more likely to survive the drought, were larger and more inflated than those found in small streams, although it has yet to be proven if this represents two distinct species. *A. oregonensis* was gravid in the late summer, although no fish were observed infested with glochidia. This may make *A.oregonensis*. even more susceptible to the negative effects of drought than *M.falcata,* which releases glochidia in the spring. At one desiccated location, 300 *A. oregonensis* were transplanted approximately 0.25 mi. upstream to a pool. They were observed alive and feeding the following summer. The impact of the drought was much greater on *Anodonta oregonensis* than *Margaritifera falcata.* Reportedly, Sycan Marsh contained one of the stronger reproducing populations of *A. oregonensis* in the region. The long-term effects of drought may reduce the range of *A. oregonensis.*, increase fragmentation, and isolate these species, key factors that may eventually result in species extinction.

2.3.2 Margaritifera Falcata Mortality Associated with an Excessive Degree of Shell Erosion in Low-hardness Waters of the Siuslaw Watershed, Oregon

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Summary: Preliminary observations of mortality rates, by noting presence of, and condition of, post-mort valves found in the study segment, indicate mortality of all age

classes, not just the older mussels. The vast majority of the mort shells are found fully-hinged, valves unbroken, but perforated. Since they are unbroken, it is unlikely that the cause of death was due to a larger predator, such as an otter, or to physical impact from moving bedload. However, all post-mort shells observed, have shown a specific type of damage; an extensive erosion of older exterior portions of the shell beyond the degree characteristic of the species. At some point, the progress of this shell erosion actually perforates the shell, exposing the soft parts of the mussel to the exterior environment, so that it no longer has its ability to defend itself by closing the valves tightly and effectively isolating soft parts from the water. At this stage, a lot more risk comes into play,1. smaller predators such as parasites can gain unrestricted access, 2.larger predators have a greatly-weakened shell structure to break, 3. pollutants that the mussel might normally deal with by closing up to let it flow on by downstream have direct contact with soft parts, 4. if the mussel became emergent during low water it no longer could seal itself off from dessication, and internal/external solute isolation is compromised. A shell with this type of erosion is at more risk than a shell without the erosion. All of the postmortem shells exhibit shell erosion, and all of the living mussels have varying degrees of shell erosion as well. All of the M falcata mussels observed in the Siuslaw watershed have shown some degree of this shell erosion. Most of the mort shells have shown erosion to the perforation stage. The frequency of mortality seems likely to be excessive for the population to be able to sustain itself over the long term. Available calcium may have dropped below prehistoric levels due to greatly reduced ocean-derived nutrient (ODN) from salmonid spawner return. It is likely that these river mussels have served as a major calcium sequestration pool for a fully functioning aquatic system. The long-lived M.falcata may have buffered the occasional years of poor fish returns with normal population turnover, yielding shells that provided recycled stream calcium. If M. falcata now is at risk of greatly increased rate of population decline, the loss of this calcium sequestration pool could be a huge blow to the general aquatic health resiliency. The study, in progress, explores potential contributing factors, including elevated ambient lead levels, in the M. falcata habitat.

2.4 Miscellaneous

2.4.1 *Freshwater "Mussel Watch" as Part of a Risk Assessment- Based Monitoring and Assessment Strategy to Characterize Stressor Exposure and Associated Effects*

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There is a need to develop an integrated biomonitoring strategy using freshwater mussels to: 1) Assess and understand their distribution; 2) Identify stressors affecting

their abundance and distribution; and 3) Manage the risks associated with these stressors and develop appropriate conservation and remediation programs. A risk assessment-based approach provides a structured paradigm for characterizing and understanding processes affecting freshwater mussel abundance and distribution, and it provides a method for distinguishing between the effects of natural stressors, chemical stressors, and anthropogenic non-chemical stressors. Routine monitoring using a risk assessment-based approach will help establish the status and trends, and health of mussel communities and populations in the Pacific Northwest. Several aquatic monitoring programs in the Pacific Northwest are designed to quantify the status and trends in ambient conditions using long-term chemical or biological monitoring approaches. A risk assessment-based Mussel Watch program is proposed to better integrate all elements of these programs. The proposed approach includes measuring tissue chemistry to characterize chemical exposure and response indicators such as biomarkers, growth, and reproduction to characterize potentially adverse biological effects. Measurement of effects endpoints are typically lacking in most Mussel Watch monitoring, which includes only chemical analysis of selected chemicals in resident or transplanted bivalves at regular intervals to establish the status and trends in environmental quality. The primary advantage of the proposed Mussel Watch monitoring over traditional monitoring of chemicals in discrete water or sediment samples is that the organisms integrate both chemical exposure and associated effects that can be quantified. The addition of a Mussel Watch Program would help the US Fish and Wildlife Service accomplish its goal of assessing and understanding freshwater mussel distributions by separating the effects of chemical and non-chemical stressors. It would also provide a method to focus other monitoring programs on a more common goal, sharing the costs of data collection and maximize the consistency of the protocols. The purpose of this paper is to focus on rationale and methods for establishing a Pacific Northwest Mussel Watch Monitoring Program that is based on the risk assessment paradigm, and to make specific recommendations for implementation. Examples will be provided where similar approaches have been utilized with both indigenous and caged bivalves. Standardized protocols using caged bivalves will also be discussed in this context.

2.4.2 *Volunteer Monitoring for Zebra Mussels in the Western U.S*

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Summary: Zebra mussels (*Dreissena polymorpha*) are native to the Caspian Sea in Asia and arrived in the Great Lakes Region via the ballast water of a transatlantic vessel in the late 1980s. Within 10 years, zebra mussels colonized the Great Lakes and the Mississippi, Tennessee, Hudson, and Ohio River Basins. In addition to clogging intake pipes and encrusting natural and man-made structures, zebra mussels filter copious amounts of water and seriously impact the aquatic community, including native mollusks. Over the past two years PSU, in collaboration with the Pacific States Marine Fisheries Commission, has established a network of volunteers in seven Western states who monitor for zebra mussels using PVC colonization substrates suspended in the water column. Over 150 substrates are deployed in lakes and rivers in OR, WA, ID, MT, WY, AZ, and UT. To date, volunteers have reported no zebra mussels; however, one volunteer discovered the first New Zealand mudsnail population in Oregon outside the Columbia River. That discovery illustrates the effectiveness of using volunteers to monitor the introduction and spread of aquatic nuisance species. The monitoring program also provides an educational benefit: Volunteers promote public awareness of invasive species issues by sharing their expertise on zebra mussels with friends and neighbors.

3 Panel Discussion

3.1 Participants

Terry Frest (Deixis Consultants), Carl Dugger (WDFW), Kevin Aitkin (USFWS), Dick Dewey (PSU), Jayne Brim-Box (USFS), Jamie Glasgow (WA Trout), Al Smith (ret. ODFW), Jen Stone (USFWS), and Howard Schaller, facilitator (USFWS)

3.2 Minutes Summarized

The objective of the panel discussion was to determine if there was an interest in developing a Technical Workgroup for freshwater mussels and to establish what the objectives would be for such a group. The panel recognized the unique opportunity to take a proactive role in a species conservation effort. They also recognized the need to provide a more regular forum to facilitate discussions involving freshwater mussel research.

All were in favor of the creation of a Technical Workgroup, though the structure of such a workgroup was not decided upon. Suggestions from the panel, as well as from the audience, indicated that both the American Fisheries Society and the Freshwater Mollusk Conservation Society might provide an example of an appropriate structure. At a minimum, the panel concluded that the Technical Workgroup should be divided

into two sections, one related to outreach and education and the other related to research, monitoring, and evaluation.

Dick Dewey from Portland State University offered to take the lead in developing the outreach and education section of the Technical Workgroup. In brief, this section will focus on mussel education directed at the public and professionals. Techniques will range from creating and distributing educational pamphlets to designing courses targeting specific training needs (monitoring and evaluation, species identification, etc). This section of the Technical Workgroup will collaborate with the Research, Monitoring, and Evaluation section.

Discussions involving the Research, Monitoring, and Evaluation section of the Technical Workgroup were more diverse. Information needs were identified and focused on species distribution (both current and historical). Data should be collected for both presence and absence data and should be geo-referenced. Data storage is an enormous concern and the discussion touched on the databases that have been developed by the USFWS, the USFS, and the BLM. Overall, the need for a centrally located, spatial, and web-accessible database is great. Additionally, protocols need to be established for data collection specific to this region. The USFS has developed a mussel survey protocol and this could be of use throughout the Pacific Northwest. Also, a simplified protocol should be created and distributed to agencies currently conducting survey work not necessarily related to mussels. Both a specimen depository and a field guide for species identification need to be established.

The efficacy of limiting this Technical Workgroup to freshwater mussels was discussed. Gastropods, for example, are extremely diverse in the Pacific Northwest and also are in need of conservation. However, this inherent diversity exacerbates the uncertainties associated with field identifications and complicates database creation, maintenance, and validity. It was decided that this Technical Workgroup would start by focusing on the freshwater mussels and determine if including gastropods is possible at a later date.

In summary, the tasks of the Technical Workgroup were established as the following:
1. Provide assistance in developing standardized sampling protocols for the Pacific Northwest to be used in mussel-specific surveys as well as in general surveys
2. Provide assistance in developing a standardized and centrally located web-based spatial database
3. Provide assistance in verifying the data that is added to the database (species identification, specimen storage, etc)
4. Coordinate sampling efforts within localized areas when possible
5. Seek out funding opportunities
6. Provide educational and outreach opportunities for both the public and private arenas

4 Next Steps; Structure and function of proposed Technical Workgroup

Information on the status, biology, habitat requirements, and distribution of freshwater mussels in the Pacific Northwest needs to be collected. To maximize the amount of information useful to conservation of these species, the USFWS has proposed establishment of a standing, multi-agency Technical Workgroup. The group would serve to foster coordination among monitoring programs, standardize and guide development of monitoring techniques, and review analytical techniques for characterizing population and habitat status.

The structure and function of this Technical Workgroup needs to be established. Organizations such as the American Fisheries Society and the Freshwater Mussel Conservation Society will hopefully provide sound examples.

Appendix 1. List of Attendees.

First Name	Last Name	email	Organization	Street Address	City	State	Zipcode	Phone number	Present?
Jeff	Adams	jadams@xerces.org	Xerces Society	4828 SE Hawthorne Blvd	Portland	OR	97215	503-232-6639	No
Kevin	Aitkin	kevin_aitkin@fws.gov	USFWS	510 Desmond Dr SE, Suite 102	Lacey	WA	98503	360-753-9508	Yes
Donna	Allard	donna_allard@fws.gov	USFWS	9317 NE Hwy 99 Suite I	Vancouver	WA	98665	360-696-7605	Yes
Brady	Allen	brady_allen@usgs.gov	USGS-CRRL	5501A Cook-Underwood Rd	Bingen	WA	98605	509-538-2299	Yes
Scott	Anderson	andersea@dfw.wa.gov	WDFW	2108 SE Grand Blvd	Vancouver	WA	98661	360-906-6720	Yes
Jon	Anderson	anderjda@dfw.wa.gov	WDFW	600 Capitol Way	Olympia	WA	98501	360-902-2711	No
Kimmo	Aronsuu		CTUIR	PO Box 638	Pendleton	OR		541-966-2380	No
Peter	Bahls	peter@nwwatershed.org	Northwest Watershed Institute	2215 SE 55th Ave	Portland	OR	97215	503-235-2716	Yes

First Name	Last Name	email	Organization	Street Address	City	State	Zipcode	Phone number	Present?
Marian	Bailey	marian_bailey@fws.gov	USFWS-NNWR	100 Brown Farm Rd	Olympia	WA	98516	360-753-9467	Yes
John	Bailey	john.c.bailey@usace.army.mil	USACE	1001 Little Goose Dam Rd	Dayton	WA	99238	509-399-2233 x263	Yes
Andrea	Balla-Holden	andrea_balla-holden@urscorp.com	URS	5988 SE Kelsey Court	Port Orchard	WA	98367		No
Rex	Baxter	rex.d.baxter@usace.army.mil	USACE	201 N 3rd Ave	Walla Walla	WA	99362	509-527-7124	No
Kurt	Beardslee	kurt@washingtontrout.org	WA Trout	PO Box 402	Duvall	WA	98019	425-788-1167	Yes
Steve	Bell	bellswb@dfw.wa.gov	WDFW	P. O. Box 104	Centralia	WA	98531	360-736-2525	Yes
Kate	Benkert	kate_benkert@fws.gov	USFWS	510 Desmond Drive SE Suite 102	Lacey	WA	98503	360-753-9440	Yes
Bob	Bicknell	bicknrjb@dfw.wa.gov	WDFW	908 Smith Rd	Toutle	WA	98649	360-274-9814	Yes
Scott	Black	sblack@xerces.org	Xerces	4828 SE	Portland	OR	97215	503-	No

First Name	Last Name	email	Organization	Street Address	City	State	Zipcode	Phone number	Present?
				Hawthorne				534-2706	
Bob	Brenner	bob.brenner@metrokc.gov	King County DNR	201 S. Jackson	Seattle	WA	98104	206-296-8060	Yes
Jayne	Brim-Box	jayne_brim_box@usgs.gov	USFS	787 N 1500 East	Logan	UT	84321	435-792-4105	Yes
Jody	Brown	jbrown@stillaguamish.nsn.us	Stillaguamish Tribe	PO Box 277	Arlington	WA	98223	360-435-2755	No
Tom	Burke	burketc@earthlink.net		4715 61st St Ave NE	Olympia	WA	98516	360-455-4418	No
Lee	Cain	lcain@astoria.k12.or.us	Astoria HS Aquatic Bio Program	1001 W Marine Drive	Astoria	0R	97103	503-325-3911	Yes
Ian	Chane	ian.chane@pacificorp.com	PacifiCorp	825 NE Multnomah Suite 115	Portland	OR	97232	503-813-6621	No
David	Close	davidclose@ctuir.com	CTUIR					541-966-2380	Yes
Diane	Concannon	diane.concannon@metrokc.gov	King County DNR	201 S. Jackson St. Suite 600	Seattle	WA	98104	206-296-	No

First Name	Last Name	email	Organization	Street Address	City	State	Zipcode	Phone number	Present?
								8017	
Pat	Connolly	patrick_connolly@usgs.gov	USGS-COOK	5501a Cook-Underwood Rd	Cook	WA	98605	509-538-2299	No
Anita	Cook	acook@ndow.org	Nevada Division of Wildlife	1100 Valley Rd	Reno	NV	89512	775-688-1532	Yes
Timothy	Darland	timothy.j.darland@nwp01.usace.army.mil	USACE	P. O. Box 150	Cascade Locks	OR	97014	541-374-4551	Yes
John	Davis	john_r_davis@fws.gov	USFWS	2600 98th Ave	Portland	OR	97266	503-231-6179	Yes
Dick	Dewey	deweyr@ses.pdx.edu	Portland State University	P. O. Box 1491	Portland	OR	97207	503-725-5388	Yes
James	Dillon	james.t.dillon@nwp01.usace.army.mil	USACE (Dalles c/o fisheries)	P. O. Box 564	The Dalles	OR	97058	541-506-7823	No
Robyn	Draheim	draheim@pdx.edu	Portland State University	ESR PO Box 751	Portland	OR	97207	503-725-4994	Yes
Pam	Drulinger	pam_druliner@blm.gov	BLM--Owyhee Field Office					208-284-3464	No

First Name	Last Name	email	Organization	Street Address	City	State	Zipcode	Phone number	Present?
Carl	Dugger	duggecrd@dfw.wa.gov	WDFW	2108 SE Grand Blvd	Vancouver	WA	98661	360-906-6729	Yes
Nancy	Duncan	nduncan@or.blm.gov	OR BLM	777 Garden Valley Blvd	Roseburg	OR	97470	541-464-3338	Yes
Martin	Ellenburg	ellensme@dfw.wa.gov	WDFW	2108 Grand Blvd	Vancouver	WA	98661	360-906-6757	Yes
Rod	Engle	rod_engle@fws.gov	USFWS	9317 NE Hwy 99 Suite I	Vancouver	WA	98665	360-696-7605	Yes
Karen	Fevold	klfevold@hotmail.com	King County	1235 NE 90th St	Seattle	WA	98115		No
Vicki	Finn	vicki_finn@fws.gov	USFWS--Regional Office	911 NE 11th Ave	Portland	OR	97232	503-872-2763	Yes
John	Fleckenstein	john.fleckenstein@wadnr.gov	Natural Heritage Program--DNR	P. O. Box 47014	Olympia	WA	98504 7014	360-902-1674	Yes
Ken	Fone	kenneth.r.fone@usace.army.mil	USACE	Lower Monumental Dam PO Box 10	Kahlotus	WA	99335	509-282-7216	Yes

First Name	Last Name	email	Organization	Street Address	City	State	Zipcode	Phone number	Present?
Terry	Frest	tjfrest@earthlink.com	Deixis	2517 NE 65th St	Seattle	WA	98115	206-527-6764	Yes
Robert	Fuerstenberg	robert.fuerstenberg@metrokc.gov	King County	201 S. Jackson Suite 600	Seattle	WA	98104		Yes
Dennis	Gilliland	gillidrg@dfw.wa.gov	WDFW	2108 Grand Blvd	Vancouver	WA	98661	360-906-6733	Yes
Jamie	Glasgow	jamie@washingtontrout.org	Washington Trout	PO Box 402	Duvall	WA	98019	425-788-1167	Yes
Jarvis	Gust	jarvis_gust@fws.gov	USFWS-OSO	2600 SE 98th Ave Suite 100	Portland	OR	97266	503-231-6179	Yes
Richard	Gustafson	rick.gustafson@noaa.gov	NMFS	2725 Montlake Blvd E.	Seattle	WA	98112	206-860-3372	No
Molly	Hallock	hallomh@dfw.wa.gov	WDFW	600 Capital Way North	Olympia	WA	98501	360-902-2818	Yes
Mark	Halupczok	mark.a.halupczok@usace.army.mil	USACE	2763 Monument Drive	Burbank	WA	99323	509-543-3207	Yes
Daniel	Harmon	harmodh@dfw.wa.gov	WDFW	SE 148 Skookum Inlet	Shelton	WA	98584	360-427-	No

First Name	Last Name	email	Organization	Street Address	City	State	Zipcode	Phone number	Present?
				Rd				1693	
Dennis	Harvey	djharvey@onemain.com	Fish First	3753 NW 30th Ave	Camas	WA	98607	360-834-6566	Yes
John	Heimburg	anarchx@hotmail.com		PO Box 11413	Olympia	WA	98508	360-570-9603	Yes
Ray	Heller	Ray.Heller@METROKC.GOV	King County	201 S. Jackson St., Suite 600	Seattle	WA	98104	206-296-8391	Yes
Tiffany	Hicks	hickstlh@dfw.wa.gov	WDFW	600 Capitol Way North Mailstop 43200	Olympia	WA	98501	360-902-2544	Yes
Paul	Hohenlohe	phohenlohe@fs.fed.us	Corvallis Forestry Sciences Laboratory	3200 SW Jefferson Way	Corvallis	OR	97331	541-750-7403	Yes
Jeanette	Howard	jhowie@uclink4.berkeley.edu	UC Berkeley	507 McCone Hall Department of Geography	Berkeley	CA	94720	510-428-2470	Yes
Matthew	Hunter	matthew.v.hunter@state.or.us	ODFW	2001 Marine Drive Room 120	Astoria	OR	97103	503-325-2462	Yes
David	Hurson	dave.f.hurson@usace.army.mil	USACE	201 N 3rd Ave	Walla	WA	99362	509-	No

First Name	Last Name	email	Organization	Street Address	City	State	Zipcode	Phone number	Present?
								6706	
Diane	Kightlinger	eclipse@gorge.net	PSU Center for Lakes and Res.	1831 NE Going St	Portland	OR	97211	503-288-2095	Yes
Ray	Kinney	kennyr@casco.net	Siuslaw Watershed Council	91636 West Fork Rd	Deadwood	OR	97430	541-964-3981	Yes
Marie	Kopka	marie.h.kopka@nwp01.usace.army.mil	USACE	Bonneville Dam	Cascade Locks	OR	97014	541-374-8801	Yes
Olaf	Langness	langnol@dfw.wa.gov	WDFW	2108 Grand Blvd	Vancouver	WA	98661	360-906-6741	Yes
Terry	Lavender	tlavender@worldnet.att.net	Water Tenders	17304 208th AVE NE	Woodinville	WA	98072	425-788-2304	Yes
Jill	Leary	jleary@tnc.org	The Nature Conservancy	821 SE 14th Ave	Portland	OR	97214	503-230-9639	No
Bill	Leonard	bill.leonard@noaa.gov	NOAA Fisheries	510 Desmond Drive SE	Lacey	WA	98504		Yes
Kevin	Li	kevin.li@metrokc.gov	King County Environmental Lab	322 West Ewing St	Seattle	WA	98119	206-684-2344	Yes

First Name	Last Name	email	Organization	Street Address	City	State	Zipcode	Phone number	Present?
Sam	Lohr	sam_lohr@fws.gov	USFWS	9317 NE Hwy 99 Suite I	Vancouver	WA	98665	360-696-7605	Yes
Gino	Lucchetti	gino.lucchetti@metrokc.gov	King County DNRP	201 S. Jackson, Suite 600	Seattle,	WA	98104	206-296-8366	Yes
Rachel	Maggi	rachel.maggi@wa.usda.gov	Natural Resources Conservation Service	11104 NE 149th St Bldg C-400	Brush Prairie	WA	98606	360-883-1987 x111	Yes
Kelly	Mcallister	mcallkrm@dfw.wa.gov	WDFW	600 Capitol Way N	Olympia	WA	98501	360-902-8136	Yes
Jean	McCrae	jean.mccrae@oregonstate.edu	ODFW	2040 SE Marine Science Dr	Newport	OR	97365	541-867-4741	Yes
George	Melanson	george.w.melanson@usace.army.mil	Little Goose Lock & Dam USACE	1001 Little Goose Dam Road	Dayton	WA	99328	509-399-2233	Yes
Glen	Mendel	mendegwm@dfw.wa.gov	WDFW	615 E J St	Dayton	WA	99328	509-382-1005	No
Mary Lou	Mills	millsmlm@dfw.wa.gov	WDFW	600 Capital Way N	Olympia	WA	98501	360-902-2834	Yes

First Name	Last Name	email	Organization	Street Address	City	State	Zipcode	Phone number	Present?
Carmen	Olds	carmenolds@hotmail.com	Seattle Aquarium	9407 Classic Drive NE	Lacey	WA	98516	360-491-5110	Yes
Yangdog	Pan	bwyp@odin.pdx.edu	Portland State University		Portland	OR	97207	503-725-4981	No
Blaine	Parker	parb@critfc.org	CRITFC	729 NE Oregon St Suite 200	Portland	OR	97232	503-731-1268	Yes
Diana	Perez	dperez@fs.fed.us	Gifford Pinchot National Forest	10600 NE 51st	Vancouver	WA	98682	360-891-5108	No
Rob	Plotnikoff	rplo461@ecy.wa.gov	WA Dept of Ecology	PO Box 47710	Olympia	WA	98504	360-407-6687	No
Mark	Plummer	mark.f.plummer@usace.army.mil	USACE	2763 Monument Drive	Burbank	WA	99323	509-543-3208	Yes
Jen	Poirier	jennifer_poirier@fws.gov	USFWS	9317 NE Hwy 99 Suite I	Vancouver	WA	98665	360-696-7605	No
Ken	Popper	kpopper@tnc.org	The Nature Conservancy	821 SE 14th Ave	Portland	OR	97214	503-230-1221	Yes
Ann	Potter	potteaep@dfw.wa.gov	WDFW	600 Capitol	Olympia	WA	98506	360-	No

First Name	Last Name	email	Organization	Street Address	City	State	Zipcode	Phone number	Present?
				Way N				902-2496	
David	Price	pricedmp@dfw.wa.gov	WDFW	600 Capitol Way N	Olympia	WA	98501	360-902-2565	Yes
Charlie	Quinn	cquinn@tnc.org	The Nature Conservancy	375 Mary Lane	Eugene	OR	97405	541-344-0023	Yes
Lisa	Renan	lisarenan@yahoo.com	WDFW	2108 SE Grand Blvd	Vancouver	WA	98661	360-906-6729	Yes
Mike	Salazar	appbio@attbi.com	Applied Biomonitoring	11648 72nd Place NE	Kirkland	WA	98034	425-823-3905	Yes
Sandra	Salazar	appbio@attbi.com	Applied Biomonitoring	11648 72nd Place NE	Kirkland	WA	98034	425-823-3905	No
Howard	Schaller	howard_schaller@fws.gov	USFWS	9317 NE HWY 99 Suite I	Vancouver	WA	98665	360-696-7605	Yes
Mike	Scharpf	scharrms@dfw.wa.gov	WDFW	600 Capitol Way	Olympia	WA	98501	360-902-2686	No
Dick	Schatzel		Water Tenders						Yes

First Name	Last Name	email	Organization	Street Address	City	State	Zipcode	Phone number	Present?
Eric	Scheuering	eric.scheuering@oregonstate.edu	Oregon Natural Heritage Information Center	1322 SE Morrison St.	Portland	OR	97214	503-731-3070	Yes
Cindy	Schexnider	cindy_schexnider@fws.gov	USFWS	310 Desmond Drive SE	Lacey	WA	98501	360-459-4934	Yes
Jason	Seivers	jseivers@tnc.org	The Nature Conservancy	821 SE 14th Ave	Portland	OR	97214	503-230-1221	Yes
John	Shipp		BLM	PO Box 912	Port Orford	OR	97465	541-332-5039	Yes
Al	Smith	mxasmith@pacifier.com		16661 SW Chehalem Way	Hillsboro	OR	97123	503-628-7825	Yes
Bill	Spurgeon	william.f.spurgeon@nww01.usace.army.mil	USACE	5520 Devils Canyon Rd	Kahlotus	WA	99335	509-282-7211	Yes
Mary	Stad	mary_stad@.fws.gov	USFWS	56961 SR14	Cook	WA	98651	509-538-2755	Yes
Michelle	Steg	msteg@tnc.org	The Nature Conservancy	7400 SW Barnes Rd 141	Portland	OR	97225	503-296-4962	Yes

First Name	Last Name	email	Organization	Street Address	City	State	Zipcode	Phone number	Present?
Elaine	Stewart	stewarte@metro.dst.or.us	Metro Regional Parks and Greenspaces Dept	600 NE Grand Ave	Portland	OR	97232	503-797-1515	Yes
Derek	Stinson	stinsdws@dfw.wa.gov	WDFW	600 Capitol Way North	Olympia	WA	98501	360-902-2475	Yes
Jen	Stone	jen_stone@fws.gov	USFWS	9317 NE Hwy 99 Suite I	Vancouver	WA	98665	360-696-7605	Yes
Mark	Sytsma	sytsmam@pdx.edu	Portland State University		Portland	OR	97207 0751	503-725-3833	No
Cynthia	Tait	cynthia_tait@blm.gov	OR BLM	100 Oregon St	Vale	OR	97918	541-473-6246	Yes
Andrew	Thoms	acthoms@bpa.gov	BPA	PO Box 3621	Portland	OR	97208	503-230-5827	No
Kathleen	Thornburgh	k.thornburgh@co.snohomish.wa.us	Snohomish County Surface Water Management	2731 Wetmore Ave., Suite 300	Everett	WA	98201	425-388-3464	Yes
Waverly	Thorsen	wawatson@unity.ncsu.edu	Dept of Environmental and Molecular	2523 NE Mary Ct	Poulsbo	WA	98370	360-697-6864	No

First Name	Last Name	email	Organization	Street Address	City	State	Zipcode	Phone number	Present?
				Rd				925-0953	
Erik	White	whiteerw@dfw.wa.gov	WDFW	16018 Mill Creek Blvd	Mill Creek	WA		425-379-2321	Yes
Jennifer	Whitney	whitnjlw@dfw.wa.gov	WDFW	16018 Mill Creek Blvd	Mill Creek	WA	98012	425-775-1311	Yes
David	Wolf		CTUIR	PO Box 638	Pendleton	OR		541-966-2380	Yes

Appendix 2. Minutes of the Panel Discussion

1) (K. Aitkin) We must be proactive and not reactive
2) (A. Smith) All great ideas, we need to take action and spread out information to other areas, tie NW mollusk researchers together and be an advocate for freshwater mussels
3) (D. Dewey) Lets leave today with a plan, hard to get together like this
4) (C. Dugger) WDFW main responsibility is with management. Bottom line, we need to know what is out there before we do anything else, there needs to be a real effort to determine species and species distribution in the area. Where are they, what are they, and what do they need? WDFW runs a list of "oddball" species in the area
5) (T. Frest) There is a need to ensure information produced is acted upon by management agencies or the surveys are wasted. Historical information exists and there is a need to reassess these records once new data has been collected and established in a database
6) (H. Schaller) We need to do this efficiently to move information quickly and make use of it. Lets not waste time and therefore let the information be wasted
7) Audience (J. Howard, U.C. Berkeley) It is difficult to get a hold of baseline historical data. It would be good if today we could discuss how to get the centralized database working
8) (J. Brimm-Box) The USFS has a database that could be made available to build on as a starting point for this work group. Protocols are a must for this monitoring project, and the USFS is developing a protocol for their widescale sampling needs which are currently funded
9) (A. Smith) The South is different from the western U.S. as far as field sampling goes. We need to develop a protocol that works for this area
10) (T. Frest) When will the BLM data be available and where can it be accessed? This is a first among opportunities for data collection to happen in the West
11) Audience (A. Cook, Nevada Department of Fish and Game) There is a need for a political will to do this, and now is the right time
12) (T. Frest) The time is now!
13) (A. Smith) We may be close to a petition for several species and the political climate is right to begin database activities with useful distribution data
14) Audience (N. Duncan) Listing is often denied because of insufficient data. I often deal with listing issues and we need positive distribution data, but negative data is just as important
15) Audience (Unknown) Have the tribes been involved as far as historical data documentation?
16) Audience (Unknown) David Close has expressed interest in working on this
17) (T. Frest) Historical data from tribes is available, but is not often taxonomically correct
18) (C. Dugger) Tribes need to be involved for the historical use data and the archaeological data to excavate the midden. We can develop the correct taxonomical data
19) Audience (A. Cook) We need to gain public support, it equals monetary and political support. Pamphlets should be created containing photos and information that

the public will see as interesting and informative so the public has appreciation and values the need to restore
20) Audience (Ray Heller) The group will need to pressure state and federal agencies to add data collection protocols to their field work to get the most data available from the presence of crews in the field
21) (H. Schaller) This will be a low cost effort piggy-backing on the other projects field work. Sampling protocol needs to be concretely developed, so these groups can easily collect at a minimum presence/absence and identification data. This will really increase the database
22) (K. Aitkin) It looks like we are set up to put this into action, now lets expand
23) (H. Schaller) Presence and absence information needs to be collected from these numerous field surveys and placed into a wide GIS database
24) Audience (P. Bahls) From experience, there are many maps indicating distribution. What maps should we be looking at and who should we contact to report sightings? A single group with a single protocol and database is critical
25) (D. Dewey) We need to centralize the data and this group today is a great representation of all of these agencies. Use the power of who you work for to make this happen
26) Audience (A. Cook) States tend to be "fed phobic" when dealing with their information
27) (D. Dewey) We are dealing with a few species and this may be a good start to integrate these agencies
28) (K. Aitkin) In Washington we're all talking, we just need to get all our data in one spot
29) Audience (Unknown) I live up in Bear Creek and I am involved with WA trout. Public education is critical so people know what is going on in their areas and who to contact
30) Audience (Lee Bain) Stream Net may be a good place to start for data organization
31) Audience (Unknown) Stream Net may not work for our needs, lets try something else
32) Audience (A. Cook) A central repository for data in each state involved may work well
33) (J. Brimm-Box) A mollusk database exists that includes gastropods. It may work to combine, but a separate database may be needed for mussels
34) (K. Aitkin) There are no gastropods in the USFWS database
35) (T. Frest) In the eastern U.S. there is an emphasis on freshwater mollusk conservation, in the west we need to be push for both gastropods and mussels as gastropods are more diverse and deserve the same attention. In creating our database we need to be compatible to changing technology so it can persist. If we utilize volunteers to collect data it would NOT be a good idea to allow them to collect specimens for identification. There is a lack of knowledge on identification and we need to prevent the collection of sensitive species
36) (J. Brimm-Box) Lets get a consensus on where collected specimens will be stored and be made available. This may require funding
37) Audience (A. Cook) Perhaps all agencies involved could match funding to the initial funding provided

38) (T. Frest) Specimen collections need to be in one place and identified so they are available as a collection to posterity
39) (C. Dugger) Is anyone working on a field guide for this area? If so it needs to be made available on the internet
40) (T. Frest) There are some people working on this, but there is a need to have genetic data to designate species correctly

-Group expresses an interest in creating guides
-Group expresses with the audience the need for a technical group and agrees -we have a good plan

41) Audience (Unknown) Individual databases could be maintained within agencies, contributing to a 1o database that will be web accessible including all of the data
42) (H. Schaller) In the West we need to concentrate on identifying the issues, and then say "here are databases and here are the programs" to the agencies and volunteers to then populate our databases with the information. The technical group will provide guidance to verify data in the databases
43) Audience (Unknown) Agencies need to coordinate who will sample where in their field efforts so there is not unknown resampling of the same area. We need to be aware of each other's efforts.
44) (H. Schaller) A group could be organized at AFS to coordinate efforts for sampling
45) (D. Dewey) The education piece has come up a lot. Lets designate a public education arena, University, etc., with the technical group providing the information everyone needs to know to make this happen. I offer to take the public education arena responsibility at PSU.
46) Audience (Unknown) If a working group is established the university taking the role to educate the public sounds good with the technical group responsible for the science.
47) (D. Dewey) I will send out an invitation for another meeting with the purpose of getting the education piece going
48) (H. Schaller) As a result of this discussion, we need to work on getting the information out about for what we are interested in as far as forming a technical group to our agencies. This will help us to collect expertise and get feedback to solidly create a group.
49) (K. Aitkin) What areas of concentration need to be designated?
50) (A. Smith) We need to get one agency or office to take the lead to hunt for resources
51) (H. Schaller) Our office is willing to take today's information and start talking to seek out the necessary resources
52) Audience (A. Cook, NDF&G) Lets designate leads in the group to work on certain expertise and make them happen
53) (A. Smith) The AFS model of organization is a good way to organize this group
54) (J. Brimm-Box) I will mention our plans at the National Mollusk Conservation Society Meeting to get recommendations
55) (T. Frest) The National Malacological Society is another group to consult. We also need to talk to the Journal of Shellfish Research

H. Schaller (in closing)
There is a lot of interest. Our office will solidify the notes and circulate it. Send back the interest to us along with Kevin Aitkin and we will go from there to form a technical and an educational group. Dick Dewey has the go-ahead for the educational group. An email discussion following the circulation of the discussion notes may work well to help form our interests. We need to act in a way that is all-inclusive within this region to be useful for all and in making informed decisions.
(J. Stone) Interested folks can sign-up on the note pad and check the USFWS-CRFPO website for updates

Appendix 3. List of References.

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