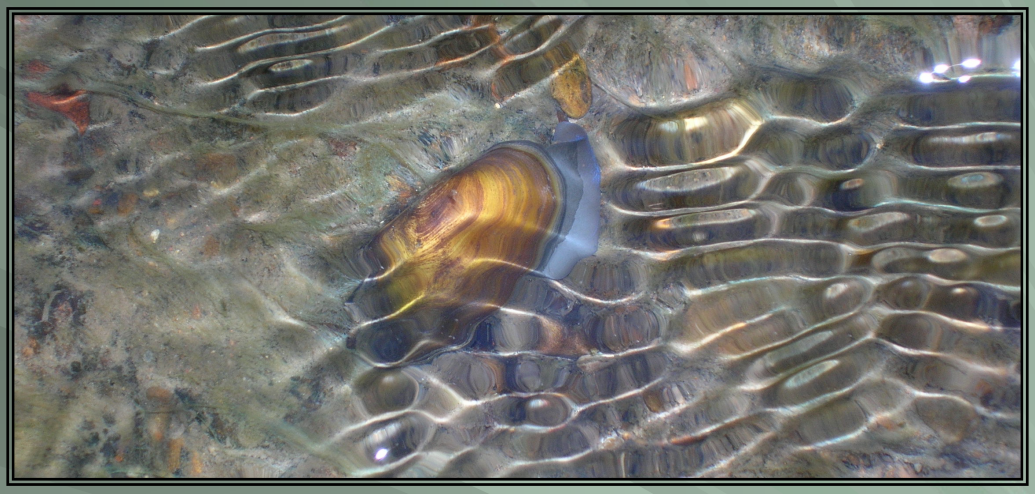
4th Annual

Freshwater Mussels Of the Pacific Northwest Symposium

~ Mussel Currents ~



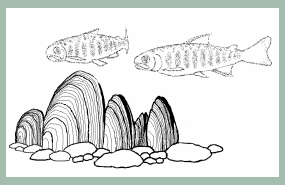
April 17th, 2007

Water Resources Education Center, Vancouver, WA

Hosted by:

the Pacific Northwest Native Freshwater Mussel Workgroup

"Dedicated to conservation of Pacific Northwest drainage mussel populations and promoting restoration, protection, education, and identification of further research needs."



Special Thanks To Our Sponsors

Bureau of Land Management
Interagency Status/
Sensitive Species Program

U.S. Fish and Wildlife Service

City of Vancouver
Water Resources Education Center

Clark County Washington
Solid Waste Program

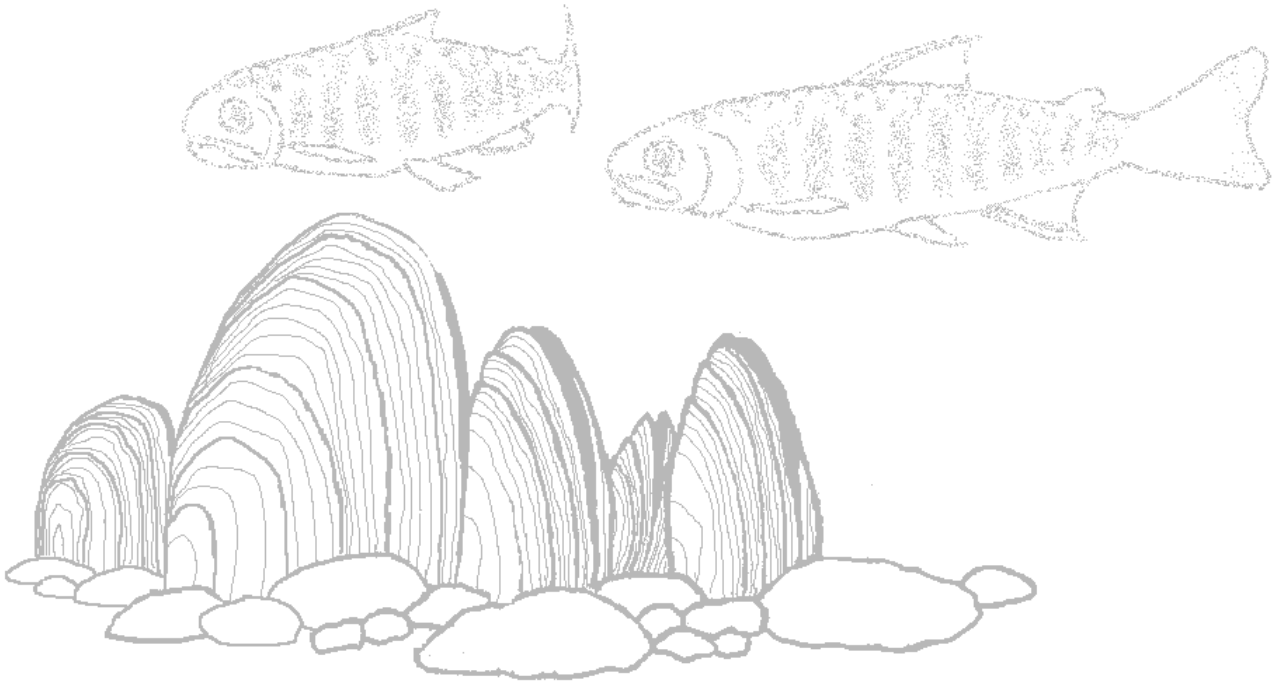
Environmental Information Cooperative
Clark County, Washington

American Fisheries Society
Oregon Chapter

Washington Department
of Fish and Wildlife

Society for Ecological Restoration
Northwest Chapter

Table of Contents



About the Pacific Northwest Native Freshwater Mussel Workgroup

History

The status of the seven species of freshwater mussels native to the Pacific Northwest has received very little attention, despite the fact that freshwater mussels in general are considered the most endangered group of animals in North America. On February 19, 2003, a workshop on freshwater mussels was held in Vancouver, Washington that consisted of presented papers and a panel discussion. The purpose of the workshop was to initiate discussion on the regional population status of freshwater mussels. The workshop was attended by 91 participants of very diverse backgrounds. From this meeting, the Pacific Northwest Native Freshwater Mussel Workgroup was founded.

Purpose

The purpose of the Workgroup is to provide an open forum for discussions focusing on native freshwater mussels, dissemination of related information, and to provide guidance on integrated planning of mussel research, management, and education. The goal of the Workgroup is to ensure that freshwater mussel research, management, and educational activities are coordinated, prioritized, and are consistent with information needs identified.

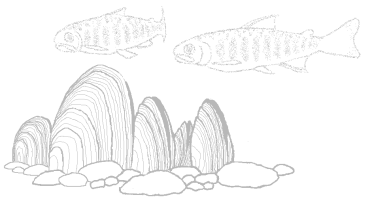
Composition

Current representation includes: U.S. Army Corps of Engineers; U. S. Bureau of Land Management; U. S. Forest Service (Utah); U.S. Fish and Wildlife Service (Washington and Alaska); U.S Geological Survey; Washington Department of Fish and Wildlife; Washington Department of Natural Resources; Snohomish County Government, Washington; Portland State University; University of Washington; Jamestown S'klallam Tribe; The Nature Conservancy; Wild Fish Conservancy; Deixis Consultants; Tetra Tech, Inc.; Bear Creek Water Tenders, Washington; Xerces Society and retired biologists.

Process

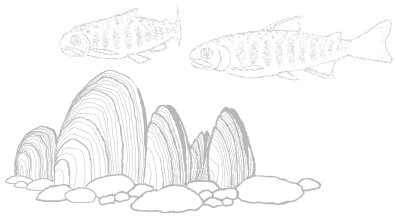
Members of the Workgroup hold an annual freshwater mussel symposium, which may be attended by anyone, for the purpose of reviewing the state of mussel research, management, and education. The location of the annual symposium rotates throughout the Pacific Northwest. Members of the Workgroup meet at least four times per year either in person, via teleconference, or by proxy) to review projects, coordinate work, discuss research priorities, and conduct other associated activities. Workgroup meeting locations rotate throughout the Pacific Northwest.

Visit the Workgroup web site: http://www.fws.gov/columbiariver/musselwg.htm

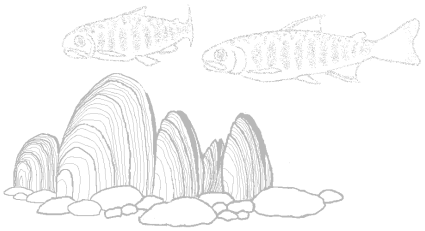


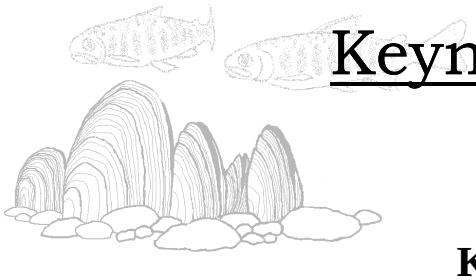
AGENDA

8:00 am - 8:50 am	Sign in, pick up lunch ticket and program, coffee and tea provided
8:50 am - 9:00 am	*"Welcome to the 4th Annual Pacific Northwest Freshwater Mussels Symposium"* Al Smith, chair of the Pacific Northwest Native Freshwater Mussel Workgroup, Hillsboro, OR
9:00 am - 10:00 am	***"Genetic Division in Western Freshwater Mussels"*** **Karen Mock, Utah State University, Logan, UT**
10:00 am - 10:15 am	Break, refreshments and beverages provided
10:15 am - 10:20 am	*"Bear Creek Session Introduction"* Wendy Walsh, Bear Creek Water Tenders, Woodinville, WA
10:20 am - 10:45 am	*"Population Dynamics of the Freshwater Mussel, Margaritifera Margaritifera falcata in Western Washington"* Kelly Toy, Jamestown S'Klallam Tribe, Sequim, WA
10:45 am - 11:10 am	*"Ecological, Water and Sediment Quality Assessment to Identify the Cause of the Freshwater Mussel (Margaritifera falcata) Decline in a Washington Stream"* Deborah Lester, King County Metro, Water and Land Resources Division, Seattle, WA
11:10 am - 11:35 am	*"Size, Age Distribution and Growth Rate of Three Populations of Freshwater Mussels (Margaritifera falcata) in King County, Washington"* Bob Brenner, King County Metro, Water and Land Resources Division, Seattle, WA
11:35 am - 12:00 pm	*"A Freshwater Mussel Relocation Experiment to Investigate Margaritifera falcata Mortality in Bear Creek, Washington"* Arden Thomas, University of Washington Graduate Student, Seattle, WA
12:00 pm - 1:00 pm	Lunch; poster session



1:00 pm - 2:00 pm	***"Silence of the Clams"*** **Tom Watters, Ohio State University, Columbus, OH**
2:00 pm - 2:25 pm	*"Using Watertype Assessments to Protect Streams"* Jamie Glasgow, Wild Fish Conservancy, Olympia, WA
2:25 pm - 2:50 pm	*"Status and Management of Western Pearlshells (Margaritifera falcata) on the Flathead Reservation, Montana"* Daniel McGuire, McGuire Consulting, Kenniwick, WA
2:50 pm - 3:15 pm	*"Two Dives in 1984, Two Rolls Exposed, and the Mussels were Spawning"* John Ratliff, Naturalist, Beaverton, OR
3:15 pm - 3:35 pm	Afternoon break, refreshments, posters
3:35 pm - 4:00 pm	*"Streamlined Survey to Document Relative Abundance and Distribution of Freshwater Mussels in Wadeable Streams"* Jake Jacobson, Snohomish County Public Works, Surface Water Management, Everett, WA
4:00 pm - 4:25 pm	*"Effects of Suction Dredge Mining on the Short-term Survival of Freshwater Mussels in the Similkameen River, Washington"* Kirk Krueger, Washington Department of Fish and Wildlife, Olympia, WA
4:25 pm - 4:50 pm	*"Factors Associated with the Localized Distribution of Adult and Juvenile Freshwater Mussels (Bivalvia:Unionoidea)"* Brian Adair, ENTRIX, Inc., Olympia, WA
4:50 pm - 5:15 pm	*"Age and Growth of Margaritifera falcata in the Pacific Northwest – Climate, Geography and Life History Variability"* Jason Dunham, United States Geological Survey, Corvallis, OR
5:15 pm - 5:30 pm	*"Closing Remarks"* Al Smith, chair of the Pacific Northwest Native Freshwater Mussel Workgroup, Hillsboro, OR

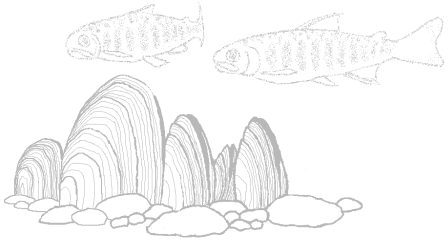




Keynote Speakers

KAREN MOCK

I am currently an assistant professor in the Wildland Resources Department at Utah State University, where my research program involves population genetics in a variety of terrestrial and aquatic species, including galliform birds, cyprinid fishes, mountain pine beetles, and unionid mussels. Although the species in my research program vary widely, there are some common threads with respect to conservation and restoration, which I think are particularly applicable and unexplored in freshwater mussels. Recently, my lab has been involved in research on freshwater mussel population dynamics in the western US and Canada, including the Bonneville Basin of Utah, the Columbia River and its tributaries, and several other localities. We are in the process of assembling large landscape-scale phylogeographic data on Anodonta, Gonidea, and Margaritifera. In these
freshwater mussel endeavors I am collaborating with Jayne Brim Box, the Confederated Tribes of the Umatilla Indian Reservation, Art Bogan, Randy Hoeh, JerPin Chong, and Joseph Furnish.



TOM WATTERS

I am a native of pastoral Beavercreek, Ohio. At an early age I became enthralled by seashells, and infused with a healthy dose of the Jacques Cousteau syndrome, I embarked
on a career in malacology. This led me to the University of Miami for my BS and the University of Rhode Island for my MS. Through a peculiar set of circumstances I ended up back in Ohio for my PhD at THE Ohio State University. Noting a profound lack of oceans in the area, I switched to freshwater mollusks. I currently am the Curator of Molluscs at the Ohio State University Museum of Biological Diversity, which houses over 2 million freshwater mollusc specimens., I am also the Science Director for the Columbus Zoo and Aquarium Freshwater Mussel Conservation and Research Facility. I have served as past president of the Freshwater Mollusk Conservation Society. In addition to mussels, my other interests include the phylogeny and zoogeography of Caribbean landsnails and GIS approaches to mollusc surveys and collections.

SPEAKER ABSTRACTS

(in order of appearance)

GENETIC SUBDIVISION IN WESTERN FRESHWATER MUSSELS, Karen E. Mock[1], Jer Pin Chong[1], David Wolf[2], Jeanette Howard[2], and Jayne Brim Box[2]. 1Wildland Resources Department, Utah State University, Logan, UT 84322-5230. 2Confederated Tribes of the Umatilla Indian Reservation, PO Box 638, Pendleton, Oregon 97801.

Genetic analysis of western freshwater mussels has revealed a set of surprising results, both at the population level and at the systematic (taxonomic) level. Prior to our research, three genera were thought to comprise the western freshwater mussel taxa. Our results suggest, however, that "*Anodonta*" may actually comprise up to three distinct genera. Furthermore, a comparative analysis of *Anodonta* populations and *Margartifera falcata* populations suggests that patterns of gene flow in these taxa are quite distinct, likely reflecting distinct dispersal mechanisms. I will be summarizing our genetic research over the past 4 years, focusing primarily on the Columbia River and its tributaries. I will include an overview of genetic techniques used in our research, and summarize our current sampling needs. Additionally, my coauthors and I will provide a set of preserved specimens (representing different genetic lineages) for conference participants to view.

POPULATION DYNAMICS OF THE FRESHWATER MUSSEL, *MARGARITIFERA MARGARITIFERA FALCATA* IN WESTERN WASHINGTON (1996-2006), Kelly A. Toy[1] and Lee Hastie[2]. 1Jamestown S'Klallam Tribe, Sequim WA, 98382. 2Department of Zoology, University of Aberdeen, Tillydrone Avenue, Aberdeen AB24 2TZ, Scotland U.K.

Margaritifera margaritifera falcata is the most common species found in Western Washington streams, however little is known about their life history and distribution. Surveys were conducted in Battle Creek, on the Tulalip Reservation and Bear Creek in Woodinville in 1995 and re-surveyed in 2006. Mussels were histologically examined to determine the gametogenic cycle for both streams. *M. m. falcata* is dioecious with occasional hermaphroditism (<1%). *M. m. falcata* was found to have a tachytictic (short-term) breeding strategy, producing a single brood late spring to early summer. Sexual maturity is achieved between 9 and 12 years and was size dependent. Water temperature was found to influence the progression of the gametogenic cycle and growth rate between streams. Significant declines in mussel numbers had occurred in both streams during the past decade. In Bear Creek, overall density estimates dropped, from 56.0–6.9 mussels.m^{-2}. In Battle Creek, overall density estimates also dropped, from 80.7–13.4 mussels.m^{-2} in 2006. Large numbers of empty shells were also found in Bear Creek in 2006, indicating high levels of mortality during the past decade. The disproportionate loss of large, old mussels resulted in a forward shift in modal age class, from 51-60 years to 31-40 years over the decade. In Battle Creek, survival appeared to be higher, although significant numbers of shells were also found in places. A lack of juvenile mussels indicated recruitment problems, possibly due to habitat degradation following

colonization of the stream corridor by beavers (*Castor canadensis*) and/or a lack of migratory host fish. Effective remedial actions for the Bear Creek and Battle Creek *M. m. falcata* populations are required within the next 5-10 years and 50 years, respectively in order to ensure their long-term survival.

ECOLOGICAL, WATER AND SEDIMENT QUALITY ASSESSMENT TO IDENTIFY THE CAUSE OF THE FRESHWATER MUSSEL (*MARGARITIFERA FALCATA*) DECLINE IN A WESTERN WASHINGTON STREAM, Deb Lester, Bob Brennerand Dean Wilson. King County Department of Natural Resources and Parks, Water and Land Resources Division, 201. S. Jackson Street, Suite 600, Seattle, WA 98104.

Freshwater mussels are declining nationwide due to a variety of factors including habitat and water quality degradation and loss of host fish populations. Bear Creek, located in a relatively undeveloped watershed in King County, Washington has historically supported a healthy population of *Margaritifera falcata*. However, concern regarding *M. falcata* in upper Bear Creek has recently increased with reports of dead and dying mussels and a severe decline in numbers; while Cottage Lake Creek which is parallel to upper Bear Creek and a tributary to lower Bear Creek, supports a relatively healthy *M. falcata* population. It is suspected that the Bear Creek *M. falcata* decline is more acute than the regional population decline observed in other areas in region. To better understand the Bear Creek mussel decline, two monitoring efforts were undertaken. The first effort evaluated mussel distribution, sex ratio, histology and substrate preference in Bear Creek and two streams (Stossel and Covington Creeks) that support relatively healthy mussel populations. The second effort evaluated sediment and water quality in Bear and Cottage Lake creeks. Sediment and water (collected under base- and storm flow conditions) quality samples were analyzed for conventional parameters, metals, organic compounds including pesticides and some endocrine disrupting compounds; toxicity tests were conducted on a subset of sediment samples. Bear Creek mussels had a 4:1 (M:F) sex ratio, and histology results indicated severe gill damage and disease. Stossel and Covington creek mussels had more balanced sex ratios and did not exhibit similar histological effects. Metals and a limited number of organic compounds were detected in surface waters and sediments; concentrations in water did not exceed criteria or other available toxicity thresholds. No toxicity was observed for *Hyallela azteca* and *Chironomous tentans*; toxicity testing with *Lampsilis siliquoidea* will be conducted in 2007.

SIZE, AGE DISTRIBUTION AND GROWTH RATE OF THREE POPULATIONS OF FRESHWATER MUSSELS (*MARGARITIFERA FALCATA*) IN KING COUNTY, WASHINGTON, Bob Brenner and Hans B. Berge. King County Department of Natural Resources and Parks, Water and Land Resources Division, 201. S. Jackson Street, Suite 600, Seattle, WA 98104.

The age structure of a mussel population offers important insight into population dynamics. Information gathered from surveys of three populations in western King County was used to describe the mussel population in a 100 m reach of each stream. Relationships between mussel size and density and various habitat characteristics were evaluated. Mussels were

collected in each population and the remaining portions of hinge ligaments were measured and the annuli were counted. Initial attempts to determine age were thwarted by the inability to accurately and consistently measure the total length of the hinge ligament. Several features on both valves were evaluated and rejected for use as reliable surrogates for the missing umbo before discovering the use of the cardinal tooth. Measurements were taken from the cardinal tooth to the posterior edge (TPE) as a surrogate for the ligament length. Scatter plots of TPE vs. shell length suggested a significant linear relationship in each of the three populations, but each was population specific. Each ligament was examined to count the annuli and measure interannual growth. Power curves described the shell length to age relationship in two populations but interference created by the disruption in the growth rates at the third site resulted in a linear relationship. Histograms of the age estimates suggest that two of the populations fit a normal curve, while another is skewed toward younger mussels. Data collected in this work suggest that the TPE measurement can be used as a surrogate for ligament length, which allows the use of empty shells in making determinations about the age of freshwater mussels. This type of work may aid in our understanding of the species response of mussels to changes in the watershed, and specific disturbances that affect the fitness of mussels in the Pacific Northwest.

A FRESHWATER MUSSEL RELOCATION EXPERIMENT TO INVESTIGATE *MARGARITIFERA FALCATA* MORTALITY IN BEAR CREEK, WA, Arden C. Thomas[1], Carolyn F. Friedman[2], and Deborah Lester[3]. 1College of Forest Resources, University of Washington, Box 352100, Seattle WA 98105. 2School for Aquatic and Fishery Sciences, University of Washington, Box 335020, Seattle WA 98105. 3King County, Water and Land Resources Division, 201 S Jackson St., Seattle, WA 98104.

Bear Creek, in the Lake Washington drainage, historically supported extensive *Margaritifera falcata* beds. In recent years this mussel population has experienced a die-off. The cause of this mortality is not readily apparent since Bear Creek drains a watershed with relatively little urbanization. Microscopic examination of stained tissue sampled from Bear Creek mussels in 2004 revealed tissue morphological changes in the digestive gland and gill tissues. Whether these changes were due to an infectious or non-infectious disease is unknown. In order to study the mussel die-offs in Bear Creek, we initiated a sentinel study to address the following questions: 1) Do healthy freshwater mussels become diseased when relocated to Bear Creek? 2) Is an infectious agent responsible for any observed disease or mortality 3) Is there a sequence of pathological events that leads to mortality? 4) Do histological and physiological parameters provide an indication of stress? In November 2006 *M. falcata* mussels from the nearby, unaffected Cottage Lake Creek population were relocated to Bear Creek. Relocated mussels are being examined for changes in tissue morphology, glycogen levels, RNA production, gamete development, and survivorship. Initial histology and glycogen results from the first four months of monitoring will be presented. The aim of this study is to identify the onset of disease in the relocated mussels and increase understanding of the biological mechanism of mortality in the Bear Creek *M. falcata* population.

THE SILENCE OF THE CLAMS, G. Thomas Watters. Department of Evolution, Ecology, and Organismal Biology, The Ohio State University, 1315 Kinnear Rd., Columbus, OH 43212.

North America's freshwater mussels are the most imperiled animals on the continent. Seventy percent are currently considered endangered, threatened, or species of special concern, and 37 species are presumed extinct. The overwhelming majority have been driven to this state by the activities of mankind. These anthropogenic causes include impoundment, runoff, mining, dredging, channelization, and loss of habitat for both mussel and host. These activities operate on both lethal and non-lethal levels. Non-lethal stress may interfere with feeding, metabolism, or decouple the host-mussel relationship. Effects on mussels from these sources are mainly a byproduct of the activity; the mussels are not themselves a target. However, other human activities have been aimed specifically at mussels. The pearl button industry, now essentially vanished, harvested thousands of tons of mussels, obliterating many beds and pushing species towards extinction. The current cultured pearl industry may be affecting mussels in the same way. The final nail in the coffin may be the invasive zebra mussel, which has decimated native mussels in many areas. For some species, human intervention in the form of captive propagation may be the only recourse to saving mussels from extinction.

USING WATERTYPE ASSESSMENTS TO PROTECT STREAMS, Jamie Glasgow. Wild Fish Conservancy, PO Box 402, Duvall, WA 98019.

Watertype assessments are an essential and cost-effective approach to protecting watersheds from negative impacts associated with adjacent land use. In Washington, forest practice activities and most local government critical areas ordinances base their streamside buffer width requirements on the presence or absence of fish habitat, as reflected by watertype. Existing regulatory watertype maps demonstrably under-represent the distribution of fish habitat. Many streams are mapped incorrectly or not at all. The Wild Fish Conservancy, through visual and electrofishing surveys, accurately maps channel locations and the distribution of fish, fish habitat, and freshwater mussels. Our projects also generate species-specific fish distribution and habitat quality data to assist with restoration project identification and prioritization efforts. The resulting GIS is used by state and local governments to update regulatory watertype maps and ultimately provide greater protection for streams.

STATUS OF WESTERN PEARLSHELL MUSSELS (MARGARITIFERA FALCATA) ON THE FLATHEAD RESERVATION, MONTANA, Daniel L. McGuire1 and Dave Marshall2. 1McGuire Consulting, Kennewick, WA. 2Polson, MT.

Since 2001, we have documented the distribution, abundance and recruitment of western pearlshells on the Flathead Reservation. We conducted over 130 presence/absence surveys on 37 reservation streams. After locating mussels, population (density and size distribution) and habitat characteristics (substrate, channel, bank, and riparian) were evaluated in each mussel-bearing stream. Western pearlshells were once more numerous and widely distributed in valley streams on the Reservation. Mussels are still fairly abundant and reproducing in portions of 4 reservation streams and a few large individuals can be found widely scattered in

5 others. However, we found only shell fragments in several stream reaches. Water is extensively managed on the Flathead Reservation and most valley streams were severely degraded during the last century. Historic stream dewatering, excess sediment deposition and diminished trout populations are considered the primary factors impacting mussel populations. In recent decades stream flow, habitat, and trout populations have improved in many streams. Nevertheless, much of the former mussel habitat remains vacant. We found evidence of recent range expansion in only one stream. Colonization of suitable, but isolated, habitat may be hindered by small parent populations and low densities in some drainages. Alternatively, western pearlshell dispersal rates may be too slow for humans to appreciate. In the next year we will be refine our field protocols and salvage mussels from a stream reach scheduled for dechannelization. As we learn more, we will consider "helping" mussels reestablish populations in what appears to be suitable habitat.

TWO DIVES IN 1984, TWO ROLLS EXPOSED, AND THE MUSSELS WERE SPAWNING, John C. Ratliff, 855 NW Winged Foot Terrace, Beaverton, OR 97006.

On May 28, 1984 I dove at the head of the Winchester Reservoir on the North Umpqua River, with my Nikonos II underwater camera with a macro ring attached. I planned to take macro "underwater photos of the mussels & small things." My dive log reads, "After #10 (photo number), noticed that mussels were secreting white milky substance (sperm?). Rest of photos of this." On June 3, 1984 I again went looking, and found, spawning mussels. This dive resulted in 21 more photos being taken. My presentation will be the first public showing of all these underwater macro photos of Western-River Pearl Mussels (*Margaritifera falcata*) spawning, taken from the original color negatives I shot in 1984. Other photos of the mussel beds in Winchester Reservoir, the North Umpqua River in the 1980s will also be presented, along with my observations as an underwater naturalist of some aquatic life in the North Umpqua. Conclusions include that the mussels spawned in the late afternoon, on warm days, when the water was close to 60 degrees, and that's when spawning activity occurs for the Redside shiner (*Richardsonius balteatus* (Richardson), and the Umpqua pike minnow (*Ptychocheilus umpquae*), which are intermediate hosts to the mussel's glochidia. Photos of these activities will be included if time permits.

STREAMLINED SURVEY TO DOCUMENT RELATIVE ABUNDANCE AND DISTRIBUTION OF FRESHWATER MUSSELS IN WADEABLE STREAMS, Jake Jacobson and Thomas Coburn. Snohomish County, 3000 Rockefeller Avenue, Everett, WA 98201.

In the summers of 2003 through 2006 Snohomish County staff surveyed to document relative abundance and distribution of freshwater mussels in tributaries to the Stillaguamish River. Surveys were conducted during periods of low flows and high visibility, and reaches were selected for the following criteria; all were fish bearing, they were physical accessible, and we had landowner consent. A team of two walked upstream slowly while visually searching for mussels in all wetted areas of the streambed. The team carried a minimum of survey equipment that included a stadia rod, hip chain, handheld GPS and Aquascope. Other gear

included polarized glasses, hip boots, ziplock bags, camera, and field forms. The starting point of each survey was selected using a road crossing or other notable feature and included a lat/long reading when available. The hip chain was used to record distance from a known point. When a mussel was located, the stream was then carefully searched downstream one channel width and upstream up to 4 channel widths within the same habitat type for an estimate of the number of visible mussels, the hip chain reading was recorded on the data sheet along with stream width, depth, substrate type, and stream habitat type. Each mussel bed was then characterized into a size class, using 3 categories.; greater than 50 individuals, 10-50, and less than 10 individuals. All data was later incorporated into an ArcGis geodatabase with the mussel bed locations snapped to the stream layer. This provides for approximate bed locations and allows us to examine density distribution information.

EFFECTS OF SUCTION DREDGE MINING ON THE SHORT-TERM SURVIVAL OF FRESHWATER MUSSELS IN THE SIMILKAMEEN RIVER, **WASHINGTON**, Kirk L. Krueger, Patrick Chapman, Molly Hallock, and Timothy Quinn. Washington Department of Fish and Wildlife, 600 Capitol Way North, Olympia, WA 98501.

Freshwater mussels are among the most imperiled taxonomic groups in North America. However, causes of mussel imperilment are often difficult to identify. Physical disturbance by suction dredge mining can affect the survival of aquatic organisms. The Washington Department of Fish and Wildlife protects freshwater mussels from the impacts of hydraulic projects, including mineral prospecting activities, but little information describing the effects of dredging on freshwater mussels is available to guide management.
We quantified the effects of entrainment, exposure, and burial by suction dredging on the short-term (6 weeks) survival of adult Western Pearlshell (*Margaritifera falcata*) and Western Ridge (*Gonidea angulata*) mussels in the Similkameen River, Washington in 2006. We exposed and buried mussels that were subjected to entrainment by a dredge and compared their survival to exposed and buried non-entrained mussels and to a control group. Entrainment and exposure resulted in no mussel mortality. Burial killed between 6 and 13 % of Pearlshell and Ridge mussels, respectively, and prevented all mussels from reorienting at the substrate surface. We compare our results with those of a pilot study we conducted in Mill Creek, Washington and with results reported in the literature. We suggest that the effects of dredging on mussel survival vary among locations and that precautionary management of mussels in Washington is warranted.

FACTORS ASSOCIATED WITH THE LOCALIZED DISTRIBUTION OF ADULT AND JUVENILE FRESHWATER MUSSELS (BIVALVIA: UNIONOIDEA), Brian Adair and James B. Layzer. Tennessee Cooperative Fishery Research Unit, Tennessee Technological University, P.O. Box 5114, Cookeville, TN 38505.

Comparative studies on the ecology of adult and juvenile freshwater mussels are few. Because of their small size, juvenile mussels are difficult to locate, and even at sites where reproduction and recruitment appear to be strong, juveniles occur in low densities. For this project, the local distribution of freshwater mussels was studied at a site where recruitment

was occurring. Ten evenly-spaced parallel transects were established within a 90-meter reach of the Duck River in Marshall County, Tennessee. Along each transect, ten sampling points were marked at 2.7-m intervals. At each point, microhabitat variables were measured, and mussels were collected from three 0.25 m^2 quadrats randomly placed within the surrounding 2.25-m^2 area. Regression analysis indicated that both adult and juvenile mussel densities were related ($p < 0.05$) to shear stress (adult $R^2 = 0.58$; juvenile $R^2 = 0.50$). Adult density was also related to substrate roughness ($R^2 = 0.64$), while juvenile density was related to substrate permeability ($R^2 = 0.73$).

AGE AND GROWTH OF MARGARITIFERA FALCATA IN THE PACIFIC NORTHWEST - CLIMATE, GEOGRAPHY, AND LIFE HISTORY VARIABILITY, Bryan Black[1], Jason Dunham[2], Daniela Zima[2], and Mark Raggon[2]. 1Oregon State University Hatfield Marine Science Center, Newport, OR. 2 U.S. Geological Survey, Forest and Rangeland Ecosystem Science Center, Corvallis, OR 97331.

Our objectives are to develop and validate methods for building freshwater mussel growth increment chronologies and relating those chronologies to the physical environment. These methods will be based on techniques developed by dendrochronlogists, which have been applied on a diverse assemblage of tree species around the world and are now being used on other long-lived animal species (rockfish and marine bivalves) in the Pacific Northwest. Over the past year we have been working to thin-section >400 valves from western pearlshells (*Margaritifera falcata*) collected during summer of 2006. Our sampling includes sites representative of diverse environmental conditions across Oregon, Washington, and Idaho. From two sites we have multi-decadal time series of stream discharge and water temperatures for comparison against growth increments of mussels. With data on local or regional climate variability and increment chronologies in hand, we hope to address the following questions: 1) how well do growth increments in mussel valves relate to local stream discharge and temperature?, 2) what are patterns of synchrony in growth of mussels within and among streams, and how does this relate to broad scale environmental gradients in space and time?, 3) what are the fundamental factors influencing the maximum age of mussels in Pacific Northwest streams? We hope results of this work will have important implications for understanding the value of mussels indicators of environmental conditions in streams and also to contribute some basic information on age and growth of the species across the region. The latter should be useful for understanding the conservation status of mussels and for understanding basic processes influencing life histories and populations.

HUNTING MUSSELS IN EASTERN WASHINGTON, Bruce Lang, Retired, Eastern Washington University, Biology. 2301 S. Chestnut St., Spokane, WA 99224. Ph: 509-624-3203. blang@aimcomm.com

From 1967 to 2007 mussels (*Margaritifera falcata*, *Gonidea angulata*, and the *Anodonta spp*. complex) have been located in 40 sites. Site information was not from systematic studies but observations made during contract work on stream assessments, graduate thesis research, fishing, invertebrate course collections, and knocking around watersheds. Data reported are

from sites I have visited and mussels that I have handled (BZL). Sites are located in 22 different systems from the Paysaten and Similkameen rivers in the northwest to Pine Creek in the southeast. Since 1967 mussel beds have been reduced or disappeared from sites on the Little Spokane River, the Spokane River, Sherman Creek, Sanpoil River, Pine Creek, Curlew Lake, and Latah (Hangman) Creek. While many mussel beds apparently disappeared, individual mussels are still found in some of these areas. In other systems, upper Crab Creek (*Anodonta*), Latah Creek (*Anodonta*, *Gonidea*), and the Little Pend Oreille River (*Margaritifera*), mussel beds are still present.
A contract study (WDFW-53081050) on Curlew Lake (1998) demonstrated *A. californiensis* (?) shells and live mussels. Electrofishing caught 146 fish (Northern Pike Minnow, Rainbow Trout, Chiselmouth, and Largemouth Bass). Most of these (96) were necropsied in the laboratory for glochidia on fins and gills. Infestation rates: NPM=48.8%; RB=33.3%; CM=40%; LMB=0.0%). Observational and experimental work conducted with three live mussels from Curlew Lake in May,1998, showed egg production on 5/19, followed by glochidia release on 6/5. In an uncontrolled trial, a clam shedding glochidia was placed with small bass (5.5-8.5cm, from Curlew Lake) in a large tank. Two of 9 were infected. In June more live clams were collected, shed glochidia, and infestations were produced in hatchery raised RB(7/20 infected) and LMB(2/15 infected).

Note: The speaker, Bruce Lang, was unable to present his talk due to a conflict in schedule.

TECHNICAL POSTERS

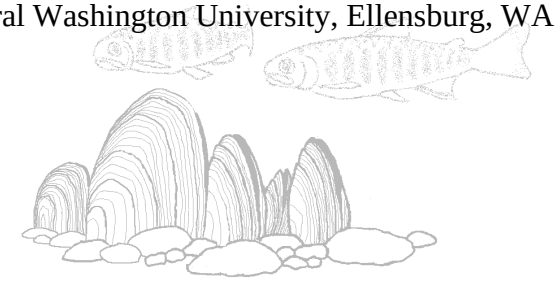
"Astoria High School Freshwater Mussel Projects"
Lee Cain, Astoria High School, OR

"Monitoring Mussel Index Plots in Pacific Northwest Watersheds"
Nancy Duncan, Bureau of Land Management, Roseburg, OR

"Margaritifera falcata Reproduction in Bear Creek, King County – a Pilot Study"
Jamie Glasgow, Wild Fish Conservancy, Olympia, WA

"MolecularDiagnostic Systems to Study the Ecology of Native and Invasive Mussels"
Rusty Rodriguez, United States Geological Survey, Seattle, WA

"Survey for Freshwater Mussels in the Upper Yakima River: an Interactive Poster"
Allen Sullivan, Central Washington University, Ellensburg, WA



POSTER ABSTRACTS

(in alphabetical order)

ASTORIA HIGH SCHOOL FRESHWATER MUSSEL PROJECTS, Lee Cain, Astoria High School, 1001 West Marine Drive, Astoria OR 97103.

Distribution and abundance of freshwater mussels in Clatsop County
Each year the AHS Fisheries Technology class will survey a new stream in the county for freshwater mussels. This spring (2007), students in the class will be teaming to map the distribution and abundance of freshwater mussels in the above-tidal reaches of the Walluski River, a stream emptying into Youngs Bay. Mussel beds will be located using visual surveys with plexiglass-bottomed buckets. Mussel beds will be located and mapped for: percent composition substrate, depth, average mussel density and average age by ring count. [Jake Banta, Tom Jaworski, Justin Litwin, Alex Ferber, Mathias Brause, Brendan Landwehr, Kyle Harrington]

Salinity tolerance of western pearlshell mussels (*Margaritifera falcata*).
Streams in the western half of Clatsop County are tidal in their lower reaches. Many of these streams flow from separate headwater sources yet have corresponding populations of western pearlshell mussels. Two students in the Fisheries Technology class will expose small groups of mussels to gradually increasing salinities in recirculating aquaria in an attempt to determine the LD_{50} salinity tolerance of western pearlshells. It is hoped that this study will shed light on the capacity of *M. falcata* to migrate between drainages. [Jake Banta, Tom Jaworski]

Effects of zinc chloride and copper chloride on the general health of western pearlshell mussels (*Margaritifera falcata*).
Freshwater mussels are known to be sensitive to industrial pollutants. Two students in the AHS Fisheries Technology class will expose small groups of mussels in recirculating aquaria to serial dilutions of zinc and copper chloride in an attempt to determine the LD_{50} of western pearlshells. [Justin Litwin, Alex Ferber]

MONITORING MUSSEL INDEX PLOTS IN PACIFIC NORTHWEST WATERSHEDS, Nancy L. Duncan. Bureau of Land Management, 777 Garden Valley Blvd., Roseburg, OR 97470.

The Pacific Northwest Native Freshwater Mussel Workgroup in cooperation with The Pacific Northwest Aquatic Monitoring Partnership is initiating the monitoring of Mussel Index Plots in selected watersheds in order to develop a baseline for mussel population demographics across the Northwest region. Local non-profit groups, state and federal agencies and other groups interested in adopting a plot are asked to sign up for a watershed that they will then monitor over several years to determine trends in abundance and size class distributions of mussel species encountered. Final Mussel Index Plot locations in target watersheds will be determined following preliminary inventory surveys which will establish occurrence and relative abundance for these species. Survey protocols have been drafted for use in federal agencies which can be used in this effort to provide consistent data quality and standardized

methods. Members of the FWMG workgroup and others are available to train surveyors and provide expertise in identification and collection practices. Experiences in conducting such monitoring in the Umpqua Basin of Douglas County, Oregon will be presented as an example of techniques and tools used.

***MARGARITIFERA FALCATA* REPRODUCTION IN BEAR CREEK, KING COUNTY – A PILOT STUDY,** Jamie Glasgow,Wild Fish Conservancy, PO Box 402, Duvall, WA 98019.

A significant data gap regarding *M. falcata* reproduction is the ambiguity of its preferred host and population-specific timing of host infection. In May, 2006, Wild Fish Conservancy deployed two underwater time-lapse video cameras on two different groups of mature *M. falcata* in upper Bear Creek, King County. Each camera recorded for approximately ten seconds every six minutes for 24 hours. The footage was reviewed to identify fish species in the vicinity of the mature mussels, document any fish-mussel interactions, and document any release of glochidia by the mature mussels.

Bear Creek supports chinook, coho, sockeye, rainbow/steelhead, and cutthroat trout, as well as a variety of native non-salmonid fishes (primarily *Cottidae* and *Cyprinidae*). Close review of the May 2006 video footage confirms the presence of juvenile coho, and juvenile rainbow or cutthroat trout maintaining feeding positions in the immediate vicinity (within two inches) of each of the two groups of mussels monitored. Juvenile and adult sculpin, and juvenile sucker fish, were also observed in the footage but did not appear to associate with the mussels. No fish were observed to come in contact with the mussels, and no glochidia releases were observed.

This pilot study demonstrated that the underwater video monitoring approach is a useful and practical tool to attempt to document freshwater mussel and host-fish species interactions. With more study sites and longer recording periods (2-3 days per week for several weeks during the expected glochidia release), we are confident that this approach would allow us to identify the host fish species and better understand the timing and mechanism of *falcata* glochidia release.

MOLECULAR DIAGNOSTIC SYSTEMS TO STUDY THE ECOLOGY OF NATIVE AND INVASIVE MUSSELS, Rusty Rodriguez [1,2] and Marshal Hoy [1,2]. 1 U.S. Geological Survey, WFRC, 6506 NE 65th, Seattle WA, 98115. 2 University of Washington, Biology, Seattle WA 98195.

We have developed species-specific molecular diagnostic systems to discriminate native and invasive mussels in the PNW. The system is based on development of PCR primers that amplify rDNA ITS and 28s gene sequences from DNA extracted from representing any life history stage. Currently, we have developed species-specific primers for one native (Western Pearlshell, *Margaritifera falcate*) and two invasive species (Zebra mussel, *Dreissena polymorpha* and Quagga mussel, *D. burgensis*). This limited number of species-specific systems developed so far reflects samples we have been able to obtain thus far. We are pursuing additional samples that represent the remaining PNW species and can expand these

efforts to include non-PNW species. These molecular systems represent the initial stages of developing automated systems to monitor the introduction of *Dreissena* species and to study the ecology of both native and invasive species in aquatic ecosystems.

SURVEY FOR FRESHWATER MUSSELS IN THE UPPER YAKIMA RIVER: AN INTERACTIVE POSTER. Allen E. Sullivan, Gretchen Volker. Central Washington University, Department of Geography and Land Studies, 400 East University Way, Ellensburg, WA 98926.

Little is known regarding the presence and abundance of freshwater mussels in the upper Yakima River (Roza Dam to Lake Keechelus). The upper Yakima River is highly managed, with early-spring through early-autumn flows maintained at high and relatively uniform levels as reservoirs release water to provide irrigation to the lower Yakima Valley. Flows drop at the end of irrigation season, making late-autumn through winter the optimum time to survey for mussels. A survey has commenced on this portion of the river, but has experienced several unanticipated obstacles related to a lack of knowledge of potential mussel bed sites, river access, ice, fluctuating flow levels, turbidity, and inclement weather, all of which have functioned to limit sampling. To facilitate and guide the initial survey, efforts have been made to interview fly-fishing guides, Washington State and Yakama Nation fisheries biologists, and other individuals with potential knowledge of mussel bed locations. The locations of mussel beds provided by interviewees have been mapped and are serving as focus areas for surveying. A raft has been employed to increase and speed access to survey areas, and reduce surveyor exposure to low temperatures, thereby increasing survey efficiency. To date, six mussel sites have been identified in the upper Yakima River, all with Western pearlshell (*Margaritifera falcata*). The goal of this poster is to increase awareness of freshwater mussels in the Yakima River, and to encourage interactive participation in the survey. Symposium participants are requested to review the map presented in this poster, and to add, or verify, mussel bed locations based on their personal experience.

PRESENTER CONTACT INFORMATION

(in alphabetical order)

Brian Adair, ENTIX, Inc., 148 Rogers St NW, Olympia, WA 98052. Ph: 360-352-3225, Fax: 360-632-4582. badair@entrix.com

Bob Brenner, King County Department of Natural Resources and Parks, Water and Land Resources Division, 201. S. Jackson Street, Suite 600, Seattle, WA 98104. Ph: 206-296-8060, Fax: 206-296-0192. Bob.Brenner@metrokc.gov

Lee Cain, Astoria High School, 1001 West Marine Drive, Astoria OR 97103. Ph: 503-325-3911. lcain@astoria.k12.or.us

Nancy Duncan, Roseburg BLM, 777 Garden Valley Blvd. Roseburg, OR 97470. Ph: 541- 464-3338, Fax: 541- 440-4948. nduncan@or.blm.gov

Jason Dunham, U.S. Geological Survey, Forest and Rangeland Ecosystem Science Center, 3200 SW Jefferson Way, Corvallis, OR 97331. Ph: 541-750-7397, Fax: 541-758-8806. jdunham@usgs.gov

Jamie Glasgow. PO Box 402, Duvall, WA 98019. Ph :425-788-1167, Fax: 425-788-9634. jamie@wildfishconservancy.org

Jake Jacobson, Snohomish County, 3000 Rockefeller Avenue, Everett, WA 98201. Ph: 425-388-6428, Fax: 425-388-6455. jake.jacobson@co.snohomish.wa.us

Kirk L. Krueger, Science Team, Habitat Program, Washington Department of Fish and Wildlife, 600 Capitol Way North, Olympia, WA 98501. Ph: 360-902-2604, Fax: 360-902-2946. kruegklk@dfw.wa.gov

Deb Lester, King County Department of Natural Resources and Parks, Water and Land Resources Division, 201 South Jackson Street, MS KSC NR 0600,Seattle WA 98104. Ph: 206-296-8325, Fax: 206-296-0192. deborah.lester@metrokc.gov

Dan McGuire, McGuire Consulting, PO Box 764, Espanola, NM 87532. Ph: 509-430- 1219. dmcguire555@windstream.net

Karen E. Mock, Wildland Resources Department, Utah State University, Logan, UT 84322-5230. Ph: 435-797-7870 Fax: 435- 797-3796. karen.mock@usu.edu

John C. Ratliff, 855 NW Winged Foot Terrace, Beaverton, OR 97006.

Rusty Rodriguez ,U.S. Geological Survey, 6505 NE 65th, Seattle, WA 98115. Ph: 206-526-6596, Fax : 206-526-6654. Rusty_Rodriguez@usgs.gov and Affiliate Associate Professor, Biology, University of Washington, Box 355325, Seattle, WA 98195-5325

Allen Sullivan, Central Washington University, 400 E. University Way, Department of Geography and Land Studies, 98926-7420. Ph: 509- 963-2181, Fax: 509-963-1047. sulliall@cwu.edu.

Arden Thomas, College of Forest Resources, University of Washington, Box 352100, Seattle WA 98105. Ph: 206-853-4193, Fax: 206-685-7471. ardent@u.washington.edu

Kelly Toy, Jamestown S'Klallam Tribe, 1033 Old Blyn Highway,Sequim WA 98382. Ph: 360-681-4641, Fax: 360-681-4611. ktoy@jamestowntribe.org

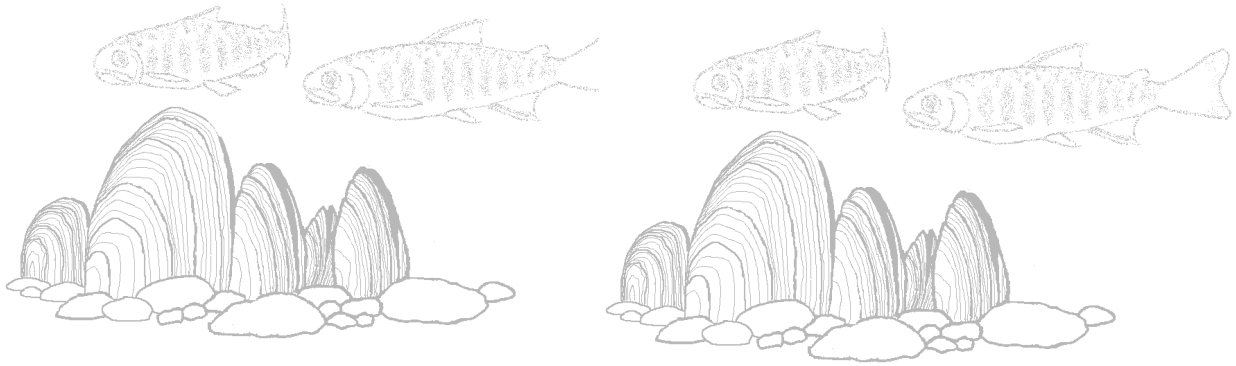
G. Thomas Watters, The Ohio State University, 1315 Kinnear Rd., Columbus, OH 43212. Ph: 614-292-6170, Fax: 614-292-7774. Watters.1@osu.edu

Attendees

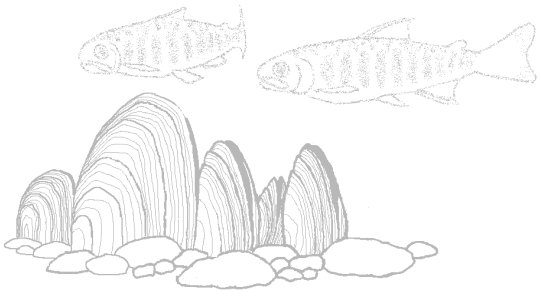
2007 Pacific Northwest Freshwater Mussel Symposium

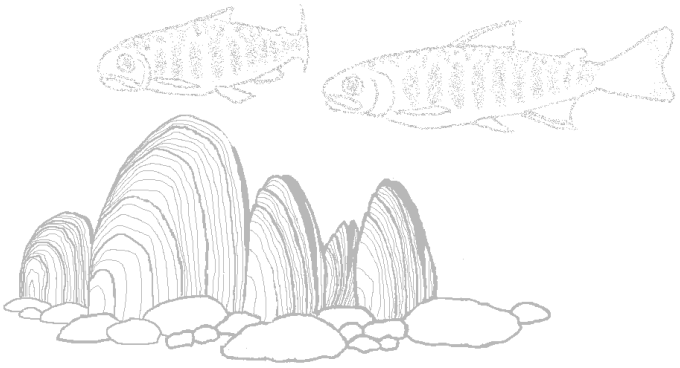
Listed Alphabetically by Last Name

Last Name	First Name	Affiliation	Address				Phone	email
Adair	Brian	ENTRIX, Inc.	4367 SW 94th Avenue	Portland	OR	97225	503-641-6589	badair@entrix.com
Adams	Jeff	Washington Sea Grant - Kitsap	345 6th Street, Suite 550	Bremerton	WA	98337-1874	360-337-4619	jaws@u.washington.edu
Aitkin	Kevin	U.S. Fish and Wildlife Service	510 Desmond Drive SE Suite 102	Lacey	WA	98503	360-753-9508	Kevin_Aitkin@fws.gov
Allard	Donna	U.S. Fish and Wildlife Service	1211 SE Cardinal CT, Suite 100	Vancouver	WA	98683	360-604-2500	donna_allard@fws.gov
Anderson	Jon	WDFW	600 Capitol Way N	Olympia	WA	98501-1091	360-902-2711	anderjda@dfw.wa.gov
Banach	Michael	Pacific States Marine Fisheries Commission / StreamNet	PSMFC, 205 SE Spokane Street, Suite 100	Portland	OR	97202	503-595-3152	mike_banach@psmfc.org
Banta	Jake	Astoria High School	1001 W Marine Drive	Astoria	OR	97103	503-325-3911 ext 301	bantajake@hotmail.com
Beaston	Rita	Scappoose Bay Watershed	57420-2 Old Portland Rd	Warren	OR	97053	503-397-7904	sbwc2@opusnet.com
Bicknell	Robert	WDFW	908 Frank Smith Rd.	Toutle	WA	98649	360-274-9814	bicknrjb@dfw.wa.gov
Brenner	Bob	King County DNRP	21332 SE 269th Street	Maple Vall	WA	98038	206-296-8060	bob.brenner@metrokc.gov
Burley			Craig			WDFW		
Byrne	Jim	WDFW	2108 Grand Blvd.	Vancouver	WA	98661	360-906-6751	byrnejbb@dfw.wa.gov
Cain	Lee	Astoria High School	1001 W Marine Drive	Astoria	OR	97103	503-325-3911 ext 301	lcain@astoria.k12.or.us
Chapman	Patrick	WDFW	600 Capitol Way N	Olympia	WA	98501	360-902-2571	chapmpfc@dfw.wa.gov
Chong	Jer Pin	Utah State University	464E 500N #5	Logan	UT	84321	435-752-1665	kma_stpz@hotmail.com
Clark	Alan	U.S. Fish and Wildlife Service	Box. 566	Cathlamet	WA	98612	360-795-3915	alan_c_clark@fws.gov
Clarke	Lance	U.S. Fish and Wildlife Service	uca-1207, 1917 Marsh Road	Yakima	WA	98901	509-575-5848 x325	lclarke@pn.usbr.gov
Clausing	Charlotte	Northwest Indian College	2522 Kwina Rd.	Bellingham	WA	98226-9217	360-676-2772 x4319	cclausing@nwic.edu
Cloen	Carol	Washington Dept. Natural Resources	1111 Washington St SE	Olympia	WA	98504	360-902-1098	carol.cloen@wa.dnr.gov
Dasher	Rhonda	Colville Confederated Tribes	23 Brooks Tracts Road	Omak	WA	98841	509-422-7439	rhonda.dasher@colvilleribes.com
Docherty	Debbie	Bonneville Power Administration	P.O. Box 3621	Portland	OR	97208	503-230-4458	dldocherty@bpa.gov
Duncan	Nancy	Bureau of Land management	777 Garden Valley Blvd.	Roseburg	OR	97470	541-464-3338	nduncan@or.blm.gov
Dunham	Jason	USGS Forest and Rangeland Ecosystem Science Center	3200 SW Jefferson Way	Corvallis	OR	97331	541-750-7397	jdunham@usgs.gov
Fernandez	Marie	U.S. Fish and Wildlife Service	Willapa NWR, 3888 State Route 101	Ilwaco	WA	98624	360-484-3482	marie_fernandez@fws.gov
Fishman	Paul	SWCA Environmental Consultants	434 NW Sixth Ave. Suite 304	Portland	OR	97214	503-224-0333 x-320	pfishman@swca.com
Fleckenstein	John	WA Natural Heritage Program	Dpt. Natural Resources	Oylmpia	WA	98501	360-902-1674	John.Fleckenstein@dnr.wa.gov
Fullerton	Arline	Doppler Enterprises, Washington State Lake Protection Assoc. (WALPA)	P.O.Box 1368	Shelton	WA	98584	360-490-4445	arlinef@hctc.com
Furnish	Joseph	U.S. Forest Service	1323 Club Drive, Mare Island	Vallejo	CA	94592	707-562-8952	jfurnish01@fs.fed.us
Glasgow	Jamie	Wild Fish Conservancy	3830 Biscay St. NW	Olympia	WA	98502	360-866-4669	jamie@wildfishconservancy.org
Graham	Jennifer	Confederated Tribes of Warm Springs	Post Office Box C, 4223 Holliday Street	Warm Springs	OR	97761	541-553-2334	jgraham@wstribes.org
Gray	Steven	WDFW	2108 Grand Blvd.	Vancouver	WA	98661	360-906-6726	grayswg@dfw.wa.gov
Gustafson	Rick	NMFS	1275 Montlake Blvd. E.	Seattle	WA	98112	206-860-3372	Rick.Gustafson@noaa.gov
Hallock	Molly	WDFW	8432 Mason NW	Olympia	WA	98502	360-902-2818	hallomh@dfw.wa.gov
Horstman	Amy	U.S. Fish and Wildlife Service	2600 SE 998th Avenue, Suite 100	Portland	OR	97266	503-231-6179	amy_horstman@fws.gov
Hoy	Marshal	U.S. Geological Survey	6505 NE 65th	Seattle	WA	98115	206-526-6282 x268	marshalhoy@hotmail.com
Hughes	Mart	Portland Parks & Recreation	5701 SE 86th Avenue	Portland	OR	97266	503-823-1694	mhughes@ci.portland.or.us
Hunter	Mathew	ODFW	2001 Marine Dr. Rm 120	Astoria	OR	97103	503-325-2462	matthew.v.hunter@state.or.us
Iwamoto	Eric	NOAA/NMFS	2725 Montlake Blvd E.	Seattle	WA	98112	206-860-3285	eric.iwamoto@noaa.gov
Jacobson	Jake	Snohomish County	3000 Rockefeller Ave, MS 607	Everett	WA	98201	425-353-2346	jake.jacobson@co.snohomish.wa.us
Jepsen	Sarina	The Xerces Society	4828 SE Hawthorne Blvd.	Portland	OR	97215	503-232-6639	sarina@xerces.org
Jim	Lyman	Confederated Tribes of Warm Springs	PO Box C	Warm Springs	OR	97761	541.553.3234	contact through: jgraham@wstribes.org



Last Name	First Name	Affiliation	Address				Phone	email
Johnson	Orlay	NOAA-NWFSC	2725 Montlake Blvd. East	Seattle	WA	98112	206-860-3253	orlay.johnson@noaa.gov
Kinney	Ray	Siuslaw Watershed Council	91636 West Fork Rd.	Deadwood	OR	97430	541 9643981	kennyr@casco.net
Kreitman	Gayle	NOAA Fisheries	510 Desmond Drive SE Suite 103	Lacey	WA	98503-1263	360-753-9887	gayle.dreitman@noaa.gov
Krueger	Kirk	WA Dept. of Fish and Wildlife, Habitat Program	600 Capitol Way, North	Olympia	WA	98501	360-902-2604	kruegklk@dfw.wa.gov
Lang	Bruce	retired	2301 S. Chestnut St.	Spokane	WA	99224	509 624-3203	blang@aimcomm.com
Lavender			Terry			Water Tenders		
Lee	Jacquie	Private	14 - 3855 Pender St	Burnaby	BC	V5C 1W5	604-294-6199	jacquielee@shaw.ca
Lester	Deb	King County Dept. Natural Resources	201 S. Jackson St. MS KSCNR 0600	Seattle	WA	98104	206 296 8325	deborah.lester@metrokc.gov
Lilly	Lori	North Coast Watershed Association	750 Commercial St., Room 205	Astoria	OR	97103	503-325-0435	llilly@columbiaestuary.org
Luzier	Christina	U.S. Fish and Wildlife Service	1211 SE Cardinal Ct., Suite 100	Vancouver	WA	98683	360-604-2500	christina_luzier@fws.gov
Macaosip	Gladys	Oregon State University	336 NW 14th Street Apt. B	Corvallis	OR	97330	541-754-7009	gladys.macaosip@oregonstate.edu
Maier	Mary	King County DNRP	201 S Jackson St	Seattle	WA	98104	206 296 1914	mary.maier@metrokc.gov
McGuire				Dan				
McNamara	Darcy	Upper Deschutes Watershed Council	PO Box 556	Bend	OR	97709	541-312-4270	mcnamara@bendcable.com
Medvick				Pat				
Meisinger	Debbie	King Conservation District	935 Powell Ave SW	Renton	WA	98057	425-277-5581 x119	debbie.meisinger@kingcd.org
Merritt	Glenn	WA Dept. Ecology	P.O. Box 47710	Olympia	WA	98504-7710	360-407-6777	gmer461@ecy.wa.gov
Mock	Karen	Utah State University	5230 Old Main Hill, Utah State University	Logan	Utah	84322	435-797-7870	karen.mock@usu.edu
Morris	Greg	Yakama Nation	PO Box 151	Toppenish	WA	98948	509-865-5121	gmorris@yakama.com
Plawman	Dave	ODFW	4907 Third St.	Tillamook	OR	97141	503-842-2741	dave.l.plawman@state.or.us
Plotnikoff	Robert	Tetra Tech, Inc. Center for Ecological Sciences	1420 Fifth Avenue, Suite 550	Seattle	WA	98101	206-728-9655	robert.plotnikoff@tetratech.com
Ramsay	Leah	BC Conservation Data Centre	395 Waterfront Cres.	Victoria	BC	V8T 5K7	250-387-9524	leah.ramsay@gov.bc.ca
Reed	Brandy	King Conservation District	935 Powell Ave SW	Renton	WA	98057	425-277-5581 x120	brandy.reed.kingcd.org
Reid	Stewart	Western Fishes	2045 East Main	Ashland	OR	97520	541-488-5154	WesternFishes@opendoor.com
Renan	Lisa	Dept. of Ecology	15 W. Yakima Ave.	Yakima	WA	98902	509-454-7653	lren461@ecy.wa.gov
Rodriguez	Rusty	U.S. Geological Survey	6505 NE 65th	Seattle	WA	98115	206-526-6596	rusty_rodriguez@usgs.gov
Roegner	Curtis	NOAA Fisheries	520 Heceta Pl.	Hammond	OR	97121	503-791-5954	curtis.roegner@noaa.gov
Schaetzel			Dick			Water Tenders		
Silver	Gregory	U.S. Fish and Wildlife Service	1211 SE Cardinal Ct, Suite 100	Vancouver	WA	98683	360-604-2500	Gregory_Silver@fws.gov
Smith	Al	Pacific NW Native Freshwater Mussel Workgroup	16661 SW Chehalem Way	Hillsboro	OR	97123	503-628-7825	mxasmith@pacifier.com
Steg Geltner	Michelle	The Nature Conservancy	821 SE 14th Ave.	Portland	OR	97215	503-802-8165	msteg@tnc.org
Stephenson	Ann	WDFW	2108 Grand Blvd.	Vancouver	WA	98661	360-906-6769	stephaes@dfw.wa.gov
Stinson	Derek	WDFW	600 Capitol Way N	Olympia	WA	98501	360-902-2475	stinsdws@dfw.wa.gov
Strand	John	Washington State University Tri-Cities	1314 Cedar Ave	Richland	WA	99354	509-943-4347	jstrand@tricity.wsu.edu
Streif	Bianca	U.S. Fish and Wildlife Service	2600 SE 98th Ave., Suite 100	Portland	OR	97266	503-231-6978	bianca_streif@fws.gov
Swanson	Andrew	Clackamas County WES	9101 SE Sunnybrook Blvd	Clackamas	OR	97015	503-353-4598	andrews@co.clackamas.or.us
Tait	Cynthia	USFS	324 25th St	Ogden	UT	84401	801-625-5658	ctait@fs.fed.us
Thomas	Arden	University of Washington	3905 High St.	Everett	WA	98201	206-853-4193	ardent@u.washington.edu
Thornburgh	Kathy	Snohomish County	3000 Rockefeller, MS 607	Everett	WA	98201	425-388-3319	k.thornburgh@co.snohomish.wa.us
Walsh	Wendy	Bear Creek Water Tenders	18000 Bear Creek Farm Road	Woodinvill	WA	98077	425-788-4434	grendyl@earthlink.net
Watters	George	Ohio State University	1952 Queensbridge Rd.	Columbus	OH	43235	614-292-6170	Watters.1@osu.edu
Weinheimer	John	WDFW	2108 Grand Blvd	Vancouver	WA	98661	360-906-6746	weinhjmw@dfw.wa.gov
Wille	Stephen	U.S. Fish and Wildlife Service	2600 SE 98th Ave., Suite 100	Portland	OR	97266	503-231-6179	Steve_Wille@fws.gov
Wolf	David	CTUIR, Freshwater Mussel Project	73239 Confederated Way	Pendleton	OR	97801	541-966-2382	davidwolf@ctuir.com





Pacific Northwest Native Freshwater Mussel Workgroup

4/05/07

Name	Organization	Phone Number	Email
Jeff Adams	Washington Sea Grant	360-337-4619	jaws@u.washington.edu
Brian Adair	Entrix, Inc. – Olympia, WA	360-352-3225	badair@entrix.com
Kevin Aitkin	U. S. Fish and Wildlife Service- Lacey, WA	360-753-9508	kevin_aitkin@fws.gov
Kathryn Barko	U.S. Army Corps of Engineers – The Dalles, OR	503-808-4883	kathryn.l.barko@nwp01.usace.army.mil
Scott Black	Xerces Society – Portland, OR	503-449-3792	sblack@xerces.org
Tom Burke	Private- Olympia, WA	360-455-4418	burketc@earthlink.net
Yvonne Colfax	Yakima Nation	509-865-4946	colfaxy@yakama.com
Dick Dewey	Portland State University- Portland, OR	503-725-5388	deweyr@pdx.edu
Robyn Draheim	Portland State University- Portland, OR	503-725-4994	draheim@pdx.edu
Nancy Duncan	Bureau of Land Management- Roseburg, OR	541-464-3338	nduncan@or.blm.gov
Jason Dunham	U.S. Geological Survey – Corvallis, OR	541-750-7397	jdunham@usgs.gov
John Fleckenstein	Wa Dept of Natural Resources- Olympia, WA	360-902-1674	John.Fleckenstein@wadnr.gov
Terry Frest	Deixis Consultants- Seattle, WA	206-527-6764	tjfrest@earthlink.net
Jamie Glasgow	Washington Trout- Duvall, WA	425-788-1164	jamie@washingtontrout.org
Molly Hallock	Wa Dept of Fish and Wildlife- Olympia, WA	360-902-2818	hallomh@dfw.wa.gov
Jake Jacobson	Snohomish Co Public Works – Everett, WA	425-388-6428	jake.jacobson@co.snohomish.wa.us
Sarina Jepsen	Xerces Society – Portland, OR	503-232-6639	sarina@xerces.org
Bruce Lang	Private – Spokane, WA	509-624-3203	blang@aimcomm.com
Jacquie Lee	Private - North Vancouver, BC	604-294-6199	jacquielee@shaw.ca
Christina Luzier	U. S. Fish and Wildlife Service-Vancouver, WA	360-604-2500	christina_luzier@fws.gov
Darcy McNamara	Upper Deschutes Watershed Council	541-312-4270	mcnamara@bendcable.com
Rob Plotnikoff	Tetra Tech, Inc., Ctr for Ecol. Science – Seattle	206-728-9655	robert.plotnikoff@tetratech.com
Al Smith*	Private- Hillsboro, OR	503-628-7825	mxasmith@pacifier.com
Michelle Steg	The Nature Conservancy- Portland, OR	503-296-4962	msteg@tnc.org
Cynthia Tait	US Forest Service – Ogden, UT	801-625-5358	ctait@fs.fed.us
Arden Thomas	University of Washington – Seattle, WA	206-853-4193	ardent@u.washington.edu
Kathy Thornburgh	Snohomish County- Public Works, Everett WA	425-388-3319	k.thornburgh@co.snohomish.wa.us
Kelly Toy	Jamestown S'Klallam Tribe- Sequim, WA	360-681-4641	ktoy@jamestowntribe.org
Brent Vadopalas	University of Washington- Seattle, WA	206-616-6341	brentv@u.washington.edu
Wendy Walsh	Bear Creek Water Tenders- Woodinville, WA	425-788-2752	grendyl@earthlink.net

* indicates Workgroup Chair