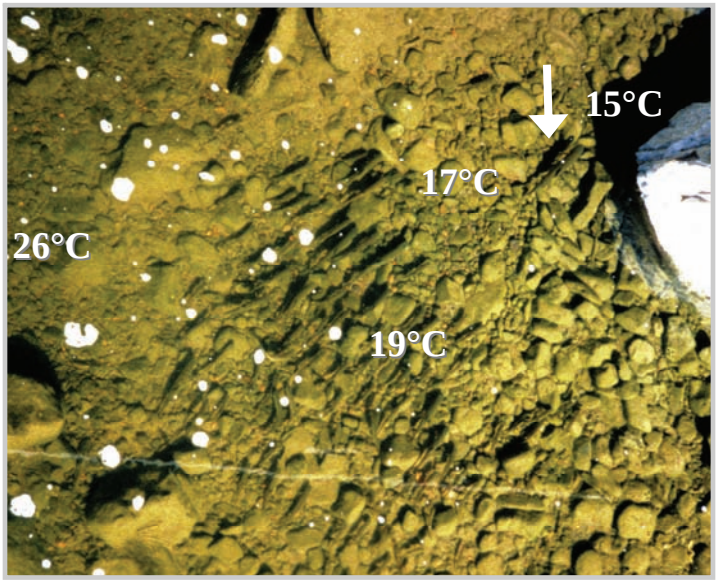
United States Environmental Protection Agency

Office of Research & Development

National Health & Environmental Effects Research Laboratory

Feature Stories

below: Trout packed into a thermal refuge. Note large trout (arrow) dominating the coolest area.
These fish are easy prey for predators like herons and otters.



Western Ecology Division

Research Update

Summer 2007

Corvallis, Oregon

EPA/600/N-07/003

BURNING QUESTIONS FOR COLD WATER FISHES

Climate change, increased demands for water, and land cover alterations can add stress to freshwater ecosystems and cause an increase in stream and river water temperatures. Along with warm summertime temperatures, these stressful conditions for fishes requiring cold water are a commonly cited reason for declines of wild salmon and trout in Pacific Northwest streams.

The best thermal refugia have overhanging vegetation, are close to feeding locations and relatively deep. Water here can be up to 10 degrees (centigrade) cooler than in main channel.

According to WED biologist **Dr. Joe Ebersole,** some of the negative thermal consequences of human actions can be mitigated. However , the costs of implementing such strategies are often high, so having a strong scientific basis for decision making is desirable. Predicting the benefits of reducing high water temperatures will depend on increasing our understanding of how temperature affects fish.

Temperatures within streams are seldom uniform, says Ebersole. Colder water from subsurface sources entering the beds and banks of streams with complex channel structure can create pockets of colder water within warm streams. These pockets may provide relief for coldwater fishes like salmon during periods of stress.

That trout and salmon use such thermal refuges to escape stressful or even lethal temperatures has been long recognized, but other factors influencing the suitability of these refuges for trout and salmon have not been previously explored.

Ebersole found that the fish also responded to refuge depth, dissolved oxygen levels, and the amount of riparian vegetation covering the refuge.

These results—that the presence of cold water alone may not be sufficient to create a useful refuge for trout and salmon during periods of warm water temperatures— are relevant to questions pertaining to ecosystem services provided by subsurface-streamwater interactions, and to the importance of intermittent streams to downstream water bodies and fish populations.

The information will be useful in efforts to protect and restore stream habitats for salmon and trout.

DELVING INTO AN OCEAN "DEAD ZONE"

What is Hypoxia?

Hypoxia (low oxygen in the water) can cause so-called "dead zones" in the ocean where living creatures are scarce. It disrupts ecosystems and can lead to massive die-offs or migration of fish and invertebrates. Recovery can take months or even years.

Hypoxia can occur when a large phytoplankton bloom is followed by a strong increase in bacteria. The bacteria feed on the dead plankton, and since bacteria require oxygen, they decrease the amount of oxygen in the water.

The initial cause of a large phytoplankton bloom could be pollution from rivers (like fertilizer runoff) or natural events like changes in ocean circulation patterns, which can cause the water to stratify (water stays in layers and doesn't mix vertically), further feeding the hypoxic conditions. Warm weather can cause water stratification and help prolong low oxygen events.

above: Dead crabs 2004 by Elizabeth Gates.
*Dungeness crabs (*Cancer magister*) washed up along the Oregon coast after succumbing to low-oxygen conditions during 2004. There are signs that hypoxia has returned to the area again this summer.*

In April 2007, **Dr. Pete Eldridge** traveled to Gulf Breeze, Florida to confer with scientists at EPA's Gulf Ecology Division and take a hypoxia sampling cruise aboard the *Bold*, EPA's ocean survey vessel.

Eldridge first spent a week working at the Naval Research Laboratory in Stennis, MS to integrate WED's biogeochemical model into the Navy's hydrodynamic model. The combined Navy/EPA model provides a framework for analyzing data collected by the *Bold*.

The Ocean Survey Vessel *Bold* is EPA's ocean and coastal monitoring vessel.

A former Navy craft, the *Bold* is now equipped with state-of-the-art sampling, mapping, and analysis equipment including side-scan sonar, underwater video, water sampling instruments, and sediment sampling devices.

She can carry a crew of up to 20 scientists, and her capabilities include monitoring of ocean dumping sites and analysis of ecological disturbances such as algal blooms.

The *Bold* can also be used to monitor air deposition and to investigate large-scale oceanic conditions such as Gulf of Mexico hypoxia events.

The study's objective was to develop a mechanistic description of processes that drive hypoxia (a recurring "dead zone") on the Louisiana Shelf off the Gulf Coast. Nutrients from the Mississippi river watershed are stimulating high levels of primary production that sink into the ocean bottom and sediments of the Louisiana Shelf, resulting in excess metabolism that reduces oxygen levels, causing extensive areas of hypoxia on the shelf.

Eldridge boarded the *Bold*, which visited three research stations from the Mississippi river outflow to the Texas/ Louisiana border, collecting measurements of water-column and sediment processes. He worked in the wet lab with Dr. Richard Devereux analyzing sediment cores using radiotracer methods. Eldridge also was part of the EPA dive team that collected these sediment cores at shallow sites not navigable by the ship. (Dives were carried out in low visibility conditions, which made the arrival of some curious manta rays all the more exciting.)

This research has led to development of a model that can simulate how the area of low oxygen develops. The model shows the importance of bottom sediments in initial depletion of oxygen from the system, followed by organic materials in the deeper layers reducing the amount of available oxygen in the rest of the water column.

This work will be useful in the evaluation of processes that must be understood for the management of Gulf hypoxia.

RECYCLING "MAKEOVER" FOR MARSHALL ISLANDS

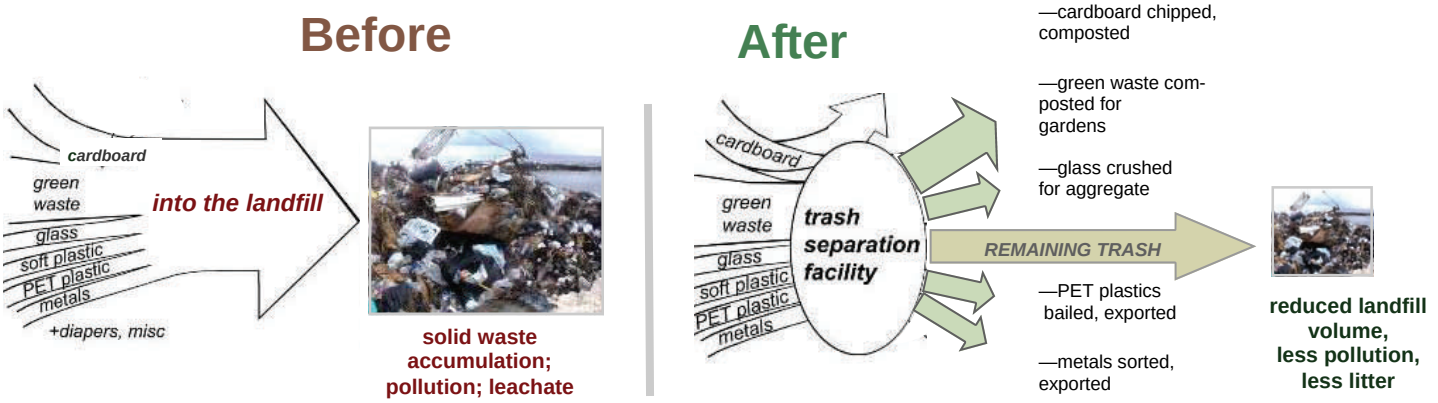
Dr. Pfleeger points out garbage covering the beach at one of the Islands' existing "legal" dumps.

Western Ecology Division scientist **Dr. Thomas Pfleeger** recently spent three months as a Science Fellow with the U.S. State Department. His assignment: to help a tiny island nation in the Pacific dig out from under a growing garbage problem.

The Marshall Islands has a fragile coral reef ecosystem which provides its major potential for economic development, (eco-tourism, sport fishing, scuba diving, etc).

Pfleeger found that parts of the main island and its shoreline were literally awash in plastic bottles, styrofoam cups, batteries and disposable diapers. Since the 1970's numerous waste management plans had been proposed, but none had resulted in permanent changes.

As seen in the diagram below *(left)*, virtually all solid waste went straight into dump sites, legal and illegal, constituting a serious problem for a small nation with limited land.



Dr. Pfleeger's primary goal was to keep recyclables out of the waste stream by designing a program of trash separation, composting and the exporting of recyclables.

With trash separation, cardboard and plant waste can be chipped and sent to a local composting facility instead of going to the landfill.

Pfleeger also oversaw a new collection program for recyclables like plastic bottles, metal, and car batteries, but overseas markets for these materials must still be found. For example, thousands of discarded auto batteries were successfully disposed of when a buyer was found in South Korea. Revenue from such self-supporting projects will be used to underwrite the cost of shipping polyethelene terephthalate (PET) plastics, cardboard and other salvaged "trash" off-island.

Dr. Pfleeger's efforts will increase public awareness and help ensure these improvements are permanent.

above: Dr. Pfleeger stands by sign at dump which directs residents to separate "green" trash (yard waste) from toxic items like batteries. Separating out green waste for composting could divert up to 50% of waste stream that formerly went into landfill.

FRESHWATER ECOLOGY BRANCH NEWS

The **EMAP West pilot study**, carried out from 2000-2004, resulted in a field operations manual that documents the standard methods for assessing wadeable streams and rivers in the western US. It describes procedures a team of 3 to 4 people can use to collect samples, measure water chemistry, note the presence of macroinvertebrates and aquatic vertebrates, check for fish tissue contaminants, and characterize surrounding physical habitat.

Groups with an interest in assessing stream quality (states, tribes, or other federal agencies) can adapt these procedures, which are based on standard methods, to use in their own stream monitoring studies.

The use of these procedures contributes to EPA's long-term goal of determining status and trends in ecological resources, based on common design and ecological indicators.

Regional streambed sedimentation assessments can be hampered by the difficulty of obtaining stream channel data that are sufficiently comprehensive and rigorous for hydraulic interpretation, yet easy to collect in a large enough sample of streams to allow statistical rigor. **Dr. Phil Kaufmann** heads a team that has adapted an index enabling a more accurate evaluation of relative stream bed stability (RBS) and anthropogenic sedimentation based on routine survey data such as that collected by EMAP (Environmental Monitoring and Assessment Program).Previous indexes have not factored in bed channel roughness, caused by large wood and other irregularities, that effectively reduces the power of a stream to transport sediment.

The new index shows promise for evaluating regional patterns in stream bed stability and sedimentation, and their relationship to human-caused disturbances.

In Brief:

Dr. Mary Kentula was presented the Merit Award of the Society of Wetland Scientists at its International Annual Conference in June 2007. Kentula received the award for her outstanding research on assessment of wetlands at the watershed scale. Her research was part of the EPA's Environmental Monitoring and Assessment Program (EMAP).

The Society of Wetlands Scientists has over 3500 members worldwide. Their purpose is exchange of current scientific and technical information; they maintain numerous other programs in support of student research

PACIFIC COAST ECOLOGY BRANCH NEWS

In Brief:

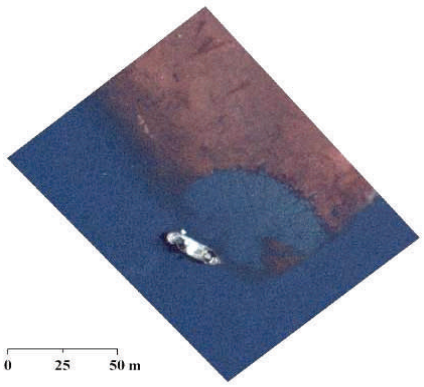
Western Ecology Division (WED)/ **Pacific Coastal Ecology Branch** in Newport, Oregon hosted a workshop in April 2007 to discuss water quality criteria for Oregon estuaries. Scientists synthesized the results of field sampling, trend analyses, and modeling approaches to produce a nutrient criteria case study for the Yaquina Estuary in Newport. The case study presents an approach that could be used by the state for establishing nutrient criteria for this system.

Represented were WED, Oregon Department of Environmental Quality, EPA Region 10 Headquarters and South Slough National Estuarine Research Reserve.

Underwater seagrasses provide the basic structure for estuarine organisms and are vital to estuarine health. Because environmental managers need a reliable, practical method for mapping seagrass beds to identify ecologically sensitive areas and monitor changes, **Dr. Theodore DeWitt** and **Patrick Clinton** conducted studies to determine the efficacy of various mapping approaches that would provide this information.

The most accurate method tested was side scan sonar coupled with underwater video. The video data were used to 'train' a computer-based mapping and classification system, and to test the accuracy of the resulting seagrass maps. These maps are highly accurate and not adversely affected by turbidity. Aerial photography and underwater video were less accurate and more costly. Trials of the side scan sonar + video approach in deeper water coastal ecosystems and in fresh water ecosystems still need to be conducted, but the method is now ready for application in shallow estuaries. See more images, page 9.

below: Color infrared aerial photograph of stranded freighter and corner of seagrass meadow. See side-scan sonar images of same area, last page.



The charismatic golden mouse, Ochrotomys nuttalli

GOLDEN MOUSE: A RARE FIND

Cross-NHEERL Eco-Division post-doc **Dr. Anita T. Morzillo's** chapter in an upcoming textbook about the golden mouse (found in the southeastern U.S.) highlights the difficulty of determining whether a species is rare or abundant. Information from a state species checklist , or random state-wide field surveys can be helpful. However, basing species presence on the amount of suitable habitat would likely overestimate the actual number of animals. These conclusions were based on a state-by-state search of documented golden mouse observations.

The chapter describes ecological and geographic factors that influence the relative abundance of rare mammals, and suggests which land use activities are most likely to affect golden mouse populations and habitat throughout its range. While it is difficult, Morzillo says, to draw conclusions about the status of a species with limited field data, her chapter does include suggestions for management of rare species and land use activities which could maintain golden mouse populations and habitat.

Morzillo and Dr. George Feldhamer co-authored the chapter in "The golden mouse: ecology, behavior, and conservation", available from Springer Publishing in November 2007.

ECOLOGICAL EFFECTS BRANCH NEWS

Traditionally, scientists have studied plant response to stressors by obtaining data from container-grown seedlings, which respond to environmental stressors differently than mature forests.

To extrapolate this data to ecosystems, **Dr. Renee Brooks** has conducted research at a whole forest ecosystem scale that measures the ability of forests to access and utilize water in response to ecosystem stresses like climate change. Information from these systems is an essential step towards protecting *functional* ecosystems that provide valued services such as clean air and water. For example, during droughts, trees can move water up from deep wet soils to resupply shallow roots and replenish moisture in dry surface soils, a process known as hydraulic redistribution. Between 20-80% of moisture lost from surface soils during the day can be replaced at night by this process.

This WED research, in collaboration with USDA and Oregon State University, is the first to quantify the amount of water that moves between soil layers during the growing season and reveal mechanisms allowing shallow roots of source-trees to release moisture back into the soil.

According to Renee Brooks (left), this research reveals the mechanisms that allow shallow roots of source-trees to release moisture back into the soil.

WED SCIENCE REACHES AROUND THE WORLD

Vienna, Austria: In May 2007, **Dr. Renee Brooks** presented a paper on stable isotopes and soil/water dynamics at the International Symposium on Advances in Isotope Hydrology. On the same trip she presented a paper in Zurich, Switzerland on stable isotopes in tree rings and how they relate to water dynamics.

Hanmer, New Zealand: **Dr. Tony Olsen** was invited by the New Zealand Institute of Mathematical Analysis of Environmental Monitoring to give a presentation on spatial monitoring designs. The objective of the international workshop on invasive species mathematical modeling was to determine the optimal use of resources between the competing demands of controlling existing invasive species and stopping new invasive species. The collaboration is expected to advance the state-of-the-science in statistical survey methods applied to rare species or resources, as well as provide an opportunity to exchange research findings.

Sapporo, Japan: **Dr. Lidia Watrud** was invited to attend a meeting of the 5th International Molecular Breeding of Forage and Turf. She presented a paper: "Evaluating the Role of Habitat Quality on Establishment of GM (genetically modified) *Agrostis stolonifera* Plants in Non-Agronomic Settings"

In Brief:

Dr. Kristina McNyset conducted a modeling workshop on predicting ecological niche use and formations in Baton Rouge, LA for Kahzak and Uzbek scientists. The Workshop, sponsored by World Health Organization Collaborating Center (WHOCC) for Remote Sensing and GIS for Public Health at LSU, included a hands-on computer lab using Kahzak and Uzbek anthrax and plague datasets.

McNyset has applied the methodology to terrestrial and aquatic species in a variety of research contexts, and is involved in many international collaborations in this area.

WHOCC has a mandate to help establish disease monitoring and assessment facilities for Former Soviet Union countries and to provide GIS training and support to their scientists.

WED SCIENCE REACHES AROUND THE WORLD

Porto, Portugal: **Dr. Tom Pfleeger** attended a meeting of SETAC (Society of Environmental Toxicology & Chemistry) in May 2007 to present a paper on off-target pesticide movement and its effect on crops, natural ecosystems, wildlife. While leaves may show little response to exposure to off-target pesticides, the reproductive effects could be significant, with potential loss or decline of plant reproductive output. Possible changes such as lack of seed or fruit production would most directly affect wildlife like nesting birds, invertebrates and small mammal granivores.

Dortmund, Germany: In March, Division Director **Dr. Thomas Fontaine** attended a meeting of the Organization for Economic Cooperation & Development. Fontaine participated in several steering groups (Working Party on Manufactured Nanomaterials) which focused on promoting international co-operation on nanomaterials research, including development of testing guidelines, material characterization, and experiments.

London, England: **Dr. Henry Lee II** participated in the Ballast Water Working Group of the United Nations' Marine Environmental Protection Committee in April 2007. Dr. Lee's assistance was requested by EPA's Office of Water and the U.S. Coast Guard. His primary role was to provide technical assistance on the section of the treaty that allows a risk assessment approach for voyages between specified ports. This approach would be in lieu of the biological-based standard that will be applied to all ships constructed after 2009. One major thrust of the meeting was to harmonize the U.S. approach with that proposed by New Zealand and Australia.

RECENT PUBLICATIONS

Beedlow, P.A., D.T. Tingey, R.S. Waschmann, D.L. Phillips, and M.G. Johnson. 2007. Bole water content shows little seasonal variation in century-old Douglas-fir trees. *Tree Physiology* 27:737-747. WED-06-033

Bracken, C.L., **C.W. Hendricks**, and A.K. Harding. 2006. Apparent bias in river water inoculum following centrifugation. Journal of Microbiological Methods 67:304-309. WED-05-107

Carroll, C., M.K. Phillips, C.A. Lopez-Gonzalez, and **N.H. Schumaker.** 2006. Defining Recovery Goals and Strategies for Endangered Species: The Wolf as a Case Study. BioScience. Vol 56. No. 1:25-37. WED-05-179

Colasanti, R.L., R. Hunt and **L. Watrud**. 2007. A simple cellular automaton model for high-level vegetation dynamics. *Ecological Modeling* 203; 363-374. WED-05-191

Crow, S.E., C.W. Swanston, K. Lajtha, **J.R. Brooks**, and H. Keirstead. 2007. Density fractionation of forest soils: methodological questions and interpretation of incubation results and turnover time in an ecosystem context. *Biogeochemistry* 85:69-90. WED-07-023

Duncan, Sally L., Lach, Denise H., and **Lackey, Robert T**. 2006. "Without a change of direction, we'll get where we're going: writing a future for wild salmon." Salmon 2100: The Future of Wild Pacific Salmon. Robert T. Lackey, Denise H. Lach, Sally L. Duncan, editors. epilogue chapter. American Fisheries Society. 619-627. WED-06-133

Ebersole, J.L., Wigington, P.J., Baker, J.P., Cairns, M.A., Church, M.R., Hansen, B.P., Miller, B.A., LaVigne, H.R., Compton, J.E., and Leibowitz, S.G. 2006. Juvenile coho salmon growth and survival across stream network seasonal habitats. Transactions of the American Fisheries Society **135**: 1681–1697. WED-05-132

Etterson, M.A., **L.R. Nagy**, and T.R. Robinson. 2007. Partitioning Risk Among Different Causes of Nest Failure. *The Auk* 124(2):432-443. WED-05-047

Fernald, A.G., **D.H. Lander**s and P.J. Wigington, Jr. 2006. Water Quality Changes in Hyporheic Flow Paths Between a Large Gravel Bed River and Off-channel Alcoves in Oregon, USA. River Research and Applications 22:1111-1124. WED-04-158

RECENT PUBLICATIONS

Ferraro, S.P., and F.A. Cole. 2007. Benthic macrofauna-habitat associations in Willapa Bay, Washington, USA. *Estuarine, Coastal and Shelf Science* 71:491-507. WED-06-076

Grams, T. E.E., and **C.P. Andersen.** 2007. Competition for Resources in Trees: Physiological Versus Morphological Plasticity. *Progress in Botany* 68:356-381. WED-06-130.

Griffith, G.E., **Omernik, J.M.,** McGraw, M.M., Jacobi, G.Z., Canavan, C.M., Schrader, T.S., Mercer, D., Hill, R., and Moran, B.C., 2006, Ecoregions of New Mexico (color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey (map scale 1:1,400,000). WED-07-049

Hageman, K.J., S.L. Simonich, D.H. Campbell, G.R. Wilson and **D.H. Landers**. 2006. Atmospheric Deposition of Current-Use and Historic-Use Pesticides in Snow at Natonal Parks in the Western United States. *Environmental Science and Technology* 40:3174-3180. WED-06-071

Harmon, M.E., **Phillips, D.L.**, Battles, J.J., Rassweiler, A., Hal, R.O., Lauenroth, W.K. (2007). Quantifying uncertainty in net primary production measurements. Chapter 12 in Fahey TJ & Knapp AK, eds., Principles and Standards for Measuring Primary Production. Oxford University Press, New York, pp. 238-260.

Hebert, A.B., J.W. Morse and **P.M. Eldridge**. 2007. Small-scale heterogeneity in the geochemistry of seagrass vegetated and non-vegetated estuarine sediments: causes and consequences. *Aquat. Geochem.*, 13:19-39. WED-07-FCO-120

Johnson, M.G., P.T. Rygiewicz, D.T. Tingey, and D.L. Phillips. 2006. Elevated CO2 and elevated temperature have no effect on Douglas-fir fine-root dynamics in nitrogen-poor soil. New Phytologist 170:345-356. WED-05-181.

Kaldy, J.E. and K.S. Lee. 2007. Factors controlling *Zostera marina* L. growth in the eastern and western Pacific Ocean: Comparisons between Korea and Oregon, USA. *Aquatic Botany* 87:116-126. WED-06-016

Kaldy, J.E., P.M. Eldridge, L.A. Cifuentes, W.B. Jones. 2006. Utilization of DOC from seagrass rhizomes by sediment bacteria: 13C-tracer experiments and modeling. Marine Ecology Progress Series 317:41-55. WED-04-121

Kaldy, J.E. 2006. Carbon, nitrogen, phosphorus and heavy metal budgets: How large is the eelgrass (Zostera marina L.) sink in a temperate estuary? Baseline/Marine Pollution Bulletin 52:332-356. WED-06-015

Kaldy, J.E. 2006. Production ecology of the non-indigenous seagrass, dwarf eelgrass, (*Zostera japonica* Ascher. & Graeb.) in a Pacific Northwest Estuary, USA. Hydrobiologia 553: 201-217.

Kaufmann, Philip R. and Hughes, Robert M. 2006. "Geomorphic and anthropogenic influences on fish and amphibians in Pacific Northwest coastal streams." American Fisheries Society book chapter. Vol. 48:429-455. WED-05-051

Lackey, R.T. 2007. Science, Scientists, and Policy Advocacy. Conservation Biology 21(1) 12-17. WED-06-166

Lach, Denise H., Duncan, Sally L., and **Lackey, Robert T**. 2006. "Can we get there from here? Salmon in the 21st Century (synthesis chapter)." Salmon 2100: The Future of Wild Pacific Salmon. American Fisheries Society. 597-617. WED-06-125

Lackey, R.T. 2006. Restoring wild salmon to the Pacific Northwest: framing the risk question. pp 3-11. In: Proceedings of the Ninth Watershed Management Council Conference: Watersheds Across Boundaries: Science, Sustainability, Security, Charles W. Slaughter and Neil Berg, Editors, November 3-7, 2002, Stevenson, Washington, University of California, Water Resources Report No. 107, 390 pp.

Lackey, R.T. 2006. Axioms of ecological policy. Fisheries. 31(6): 286-290. WED-06-032

Lackey, R.T., D.H. Lach, S.L. Duncan. 2006. Policy Options to Reverse the Decline of Wild Pacific Salmon. Fisheries; 31(7); 344-351. WED-06-025.

Lackey, R. T. 2006. "Restoring Salmon to the Pacific Northwest: Framing the Risk Question." Stevenson, WA, 11/3-6/02. 3-11. WED-03-027 Aquatic stressors Lackey, Robert T., Lach, Denise H., and Duncan, Sally L. 2006. "The Challenge of Restoring Wild Salmon." chapter 1 in Salmon 2100: The Future of Wild Pacific Salmon. 1-11. WED-06-110

Lackey, Robert T., Lach, Denise H., and Duncan, Sally L. 2006. "Salmon 2100: The future of wild Pacific salmon." Salmon 2100: The Future of Wild Pacific Salmon. American Fisheries Society. i-vii. WED-06-117

Lackey, Robert T., Lach, Denise H., and Duncan, Sally L. 2006. "Wild Salmon in Western North America: Forecasting the most likely status in 2100." chapter 3 in Salmon 2100: The Future of Wild Pacific Salmon. American Fisheries Society. 57-70. WED-06-109

Lackey, Robert T., Lach, Denise H., and Duncan, Sally L. 2006. "Wild salmon in Western North America: The historical and policy context." chapter 2 in Salmon 2100: The Future of Wild Pacific Salmon. 13-55. WED-06-108

Larsen, D.P., A.R. Olsen, S.H. Lanigan, C. Moyer, K.K. Jones and T.M. Kincaid. 2007. Sound survey designs can facilitate integrating stream monitoring data across multiple programs. *Journal of the American Water Resources Association* 43(2) 1-14. WED-05-044

RECENT PUBLICATIONS

Lawler, J.J., D. White, R.P. Neilson & A.R. Blaustein. 2006. Predicting climate-induced range shifts: model differences and model reliability. Global change Biology: 12; 1568-1584. WED-05-111.

Lee, E. H., D.T. Tingey, P.A. Beedlow, M.G. Johnson, and C.A. Burdick. 2007. Relating fine root biomass to soil and climate conditions in the Pacific Northwest. Forest Ecology and Management, 242:195-208. WED-06-170

Lowrance, R., Isenhart, T. M., Gburek, W. J., Shields Jr., F. D., **Wigington Jr., P. J.,** and Dabney, S. M. 2006. "Landscape management practices." Environmental Benefits of Conservation on Cropland, The Status of Our Knowledge. Editors Ed. Schnepf, M. and Cox, C. Soil and Water Conservation Society. 269-317. WED-06-169

Magee, T.K., **P.L. Ringold,** and M.A. Bollman. 2007. Alien species importance in native vegetation along wadeable streams, John Day River basin, Oregon, USA. *Plant Ecology* DOI 10.1007/s11258-007-9330-9. WED-06-094

McNyset, K.M. and J.K. Blackburn. 2006. Does GARP really fail miserably? A response to Stockman et al. (2006). Diversity and Distributions 12:782-786. WED-06-149

Meinzer, F.C., J.M. Warren, and **J.R. Brooks.** 2007. Species-specific partitioning of soil water resources in an old-growth Douglas-fir-western hemlock forest. Tree Physiology 27, 871-880. WED-06-178

Peterson, S.A., J. Van Sickle, A.T. Herlihy, and R.M. Hughes. 2007. Mercury Concentration in Fish from Streams and Rivers Throughout the Western United States. Environmental Science & Technology 41(1) pp. 58-65. WED-06-095

Reichman, J.R., L.S. Watrud, E.H. Lee, C.A. Burdick, M.A. Bollman, M.J. Storm, G.A. King and C. Mallory-Smith. 2006. Establishment of trasgenic herbicide-resistant creeping bentgrass (Agrostis stolonifera L.) in nonagronomic habitats. Molecular Ecology 15, 4243-4255. WED-05-183.

Schwindt, A.R., N. Truelove, C.B. Schreck. J.W. Fournie, **D. Landers**, M.L. Kent. Qualitative evaluation of macrophage aggregates in brook trout *Salvelinus fontinalis* and rainbow trout *Oncorhynchus myikss*. *Diseases of Aquatic Organisms* 68: 101-113, 2006. WED-07-FCO-118

Scott, J.M., J.L. Rachlow, **R.L. Lackey**, A.B. Pidgorna, J.L. Aycrigg, G.R. Feldman, L.K. Svancar, D.A. Rupp, D.I. Stanish, and R.K. Steinhorst. 2007. Policy Advocacy in Science: Prevalence, Perspectives, and Implications for Conservation Biologists. *Conservation Biology* 21 (1):29-35. WED-07-003

Shure, D.J., **D.L. Phillips,** P.E. Bostick (2006) Gap size and succession in cutover southern Appalachian forests: an 18 year study of vegetation dynamics. Plant Ecology 185: 299-318. WED-01-130

Sigleo, A.C., and W.E. Frick. 2007. Seasonal variations in river discharge and nutrient export to a Northeastern Pacific estuary. *Estuarine, Coastal and Shelf Science* 73:368-378. WED-06-020

Sigleo, A.C. 2006. Atmospheric CO2 Changes: Past and Future. Ehlleringer, J.R., T.E. Cerling, and M.D. Dearing editors 2005. Ecology. 87(1): 262-263. WED-05-186

Stoddard, J.L., D.P. Larsen, C.P. Hawkins, R.K. Johnson and R.H. Norris. 2006. Setting expectations for the ecological condition of streams: The concept of reference condition. Ecological Applications 16(4), pp. 1267-1276. WED-04-179

Taylor, A.M., **J.R. Brooks**, B.L. Gartner and J.J. Morrell 2007. Radial patterns of carbon isotopes in the xylem extractives and cellulose of Douglas-fir. Tree Physiology. 27:921-927. WED-06-150

Theobald, D.M., D.L. Stevens, Jr., **D. White**, N.S. Urquhart, A.R. Olsen, and J.B. Norman. 2007. Using GIS to Generate Spatially Balanced Random Survey Designs for Natural Resource Applications. *Environmental Management* 40:134-146. WED-06-028

Tingey, D.T., D.L. Phillips, E. H. Lee, R.S. Waschmann, D.M. Olszyk, P.T. Rygiewicz, and M.G. Johnson. 2007. Elevated temperature, soil moisture and seasonality but not CO2 affect canopy assimilation and system respiration in seedling Douglas-fir ecosystems. *Agricultural and Forest Meteorology* 143:30-48. WED-06-158

Van de Water, P.K., **L.S. Watrud,** E.H. Lee, C. Burdick, and G.A. King. 2007. Long-Distance GM Pollen Movement of Creeping Bentgrass using Modeled Wind Trajectory Analysis. *Ecological Applications* 17 (4), pp. 1244-1256. WED-06-134

Van Sickle, J, D.P. Larsen and C.P. Hawkins. 2007. Exclusion of rare taxa affects performance of the *O/E* index in bioassessments. *J. N. Am. Benthol. Soc.* 26 (2):319-331. WED-06-162

Van Sickle, J., J.L. Stoddard, S.G. Paulsen, and A.R. Olsen. 2006. Using Relative Risk to Compare the Effects of Aquatic Stressors at a Regional Scale. Environmental Management 38:1020-1030. WED-05-204.

Walters, D.M., K.M. Fritz, **D.L. Phillips** 2007. Reach-scale geomorphology affects organic matter and consumer d13C in a forested Piedmont stream. Freshwater Biology 52: 1105-1119. WED-07-FCO-137

Warren, J.M., **J.R. Brooks**, F.C. Meinzer, J.C. Domec and R. Coulombe 2007. Hydraulic redistribution of soil water in two old-growth coniferous forests: quantifying patterns and controls. New Phytologist. 173:753-765. WED-07-016

RECENT PUBLICATIONS

Watrud, L.S., K. Martin, K.K. Donegan, C.G. Coleman. 2006. Comparison of taxonomic, colony morphotype and PCR-RFLP methods to characterize microfungal diversity. Mycologia 98(3) pp. 384-392.

Whittier, T.R., R.M. Hughes, G.A. Lomnicky, and **D.V. Peck**. 2007. Fish and Amphibian Tolerance Values and an Assemblage Tolerance Index for Streams and Rivers in the Western USA. *Transactions of the American Fisheries Society* 136:254-271. WED-06-124

Whittier, T.R., **J.L. Stoddard**, D.P. Larsen, and A.T. Herlihy. 2007. Selecting reference sites for stream biological assessments: best professional judgment or objective criteria. *J. N. Am. Benthol. Soc.* 26(2):349-360. WED-06-147

Whittier, T.R., R.M. Hughes, **J.L. Stoddard**, G.A. Lomnicky, D.V. Peck, and A.T. Herlihy. 2007. A Structured Approach for Developing Indices of Biotic Integrity: Three examples from Streams and Rivers in the Western USA. *Transactions of the American Fisheries Society* 136:718-735. WED-06-064

Whittier, Thomas R., **Stoddard, John L**., Hughes, Robert M., and Lomnicky, Gregg. 2006. "Associations among catchment-and site-scale disturbance indicataors and biological assemblages at least- and most-disturbed stream and river sites in the western Unite States." book chapter for American Fisheries Society Symposium. American Fisheries Society. 641-664. WED-05-052 A

Wigington, Jr., P.J., J.L. Ebersole, M.E. Colvin, S.G. Leibowitz, B. Miller, B. Hansen, H.R. Lavigne, D. White, J/P. Baker, M.R. Church, J.R. Brooks, M.A. Cairns, and J.E. Compton. 2006. Coho salmon dependence on intermittent streams. *Front. Ecol. Environ.* 4(10):513-518. WED-06-146

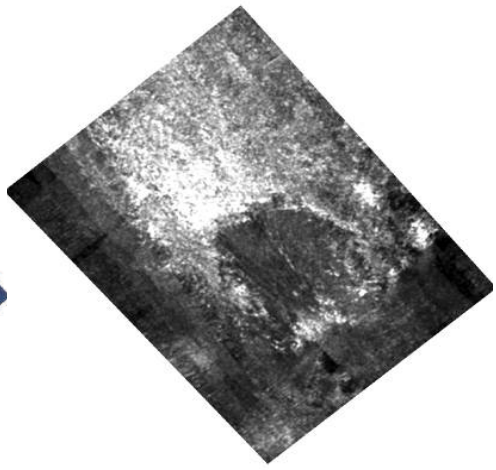
Yangdong Pan, Brian H. Hill, Peter Husby, Robert K. Hall and **Philip R. Kaufmann** 2006 Relationships Between Environmental Variables and Benthic Diatom Assemblages in California Central Valley Streams (USA). Hydrobiologia 561: 1573-5117. WED-06-111 FCO

PACIFIC COAST ECOLOGY BRANCH NEWS, CONT. FROM PAGE 4

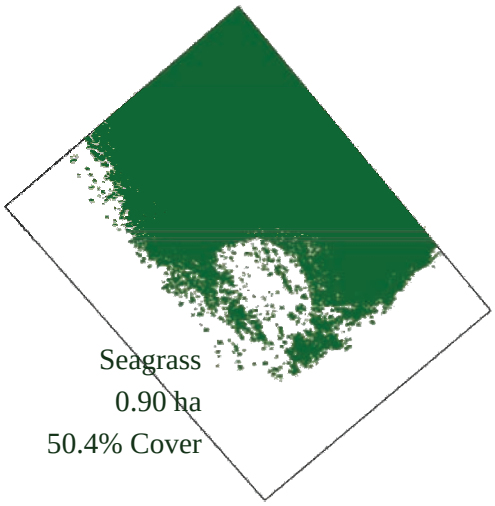
Seagrass beds are critical habitats for many economically important fish and shellfish. Many of these habitats are threatened by nutrient enrichment, chemical contamination, dredging, and other impacts.

Dr. Ted DeWitt found the most accurate method of mapping seagrass beds was also the most cost effective: side scan sonar coupled with underwater video. The images were not affected by cloudy water conditions.

Infrared aerial photography shows derelict freighter which swings on its anchor and creates a clearly visible break in the seagrass bed.



Side-scan sonar image of same site.



*Seagrass cover map of site includes estimate of **seagrass abundance** based on classification of sonar image.*

Scientists featured in this Update work at EPA's Western Ecology Division, unless otherwise noted.

For more information, contact hurley.joan@epa.gov

The information in this document has been funded wholly or in part by the U. S. Environmental Protection Agency. It has been subjected to review by the National Health and Environmental Effects Research Laboratory and approved for publication. Approval does not signify that the contents reflect the views of the Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.