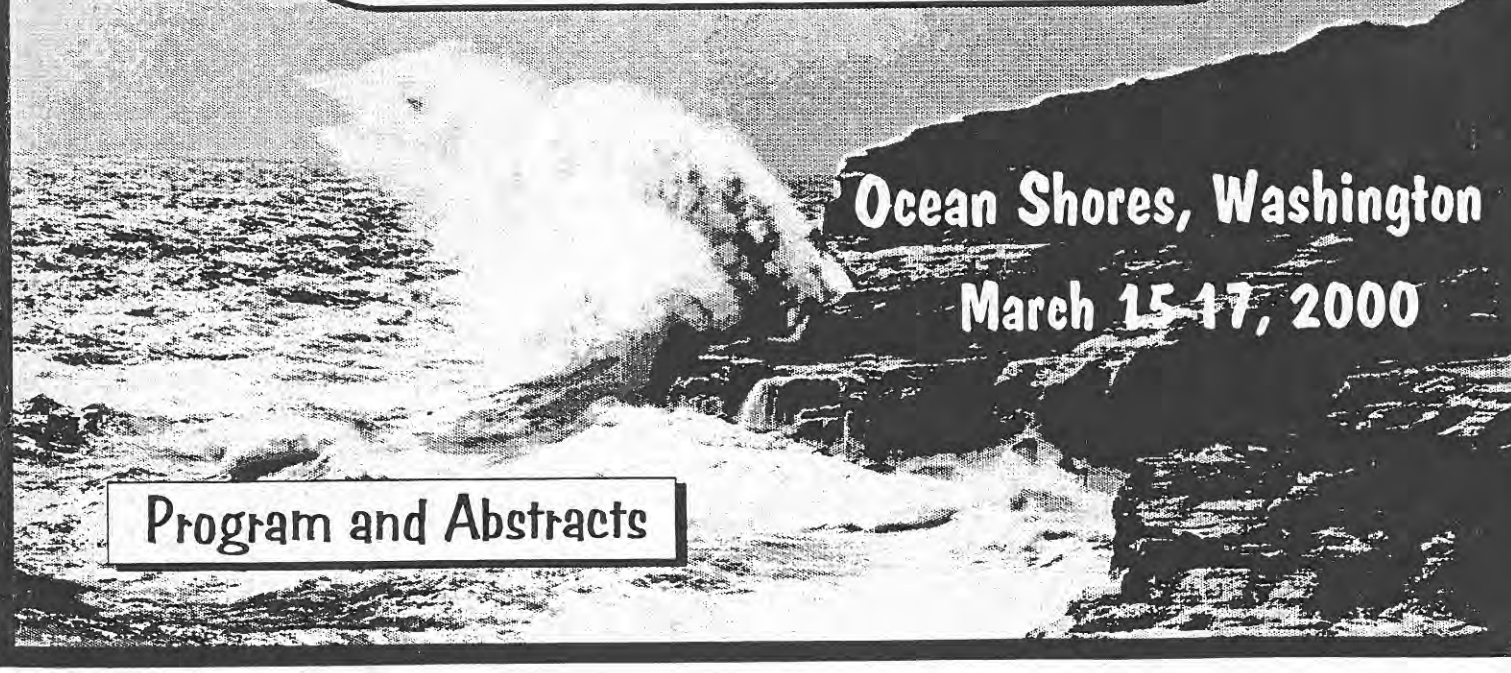
The Wildlife Society, Washington Chapter & Society for Northwestern Vertebrate Biology

Integrating Aquatic and Terrestrial Vertebrate Research and Management



Ocean Shores, Washington

March 15-17, 2000

Program and Abstracts

SOCIETY FOR NORTHWESTERN VERTEBRATE BIOLOGY
THE WILDLIFE SOCIETY, WASHINGTON CHAPTER

ANNUAL MEETING - TECHNICAL PROGRAM & SCHEDULE

Tuesday, March 14 - Workshop

8 am – 5:00	Keys to Stream Dynamics in Riparian Habitat, morning lecture and afternoon field trip. Organizer, Al Wald

Wednesday, March 15 – General Meeting

8:00 – Noon	Meeting Registration
10:00 – Noon	Concurrent Executive Board Meetings (SNVB and TWS)
1:00– 5:00	Plenary Session: *Integrating Aquatic and Terrestrial Vertebrate Research and Management*
7:00– 11:00	Social and Dance held at the Convention Center. Snacks and a no-host bar will be provided. Student Mentoring Session will run from 7:00 - 8:00 pm. A live blues band, *The Jude Bowerman Band* will close out the evening.

Thursday, March 16 - General Meeting

8:00 – Noon	Meeting Registration
8:00 – 5:00	Concurrent Sessions: Morning: 1. Aquatic and Terrestrial Species Interactions 2a. Ecology & Management of Terrestrial Amphibians 2b. Resource Management Issues and Amphibians 3. Wildlife Habitat Relationships Afternoon: 1. Wildlife Conservation 2. Riparian Amphibians
8:00 – 5:00	Poster Session, open viewing in the lobby
5:00 – 6:00	Poster Session – Authors will be present at their posters in the lobby
8:00 – 5:00	Photo contest.
Noon – 1:00	Concurrent Business meetings (SNVB/TWS).
7:00 – 11:00	Banquet (included with registration), Beachfront Shilo Resort. Awards Ceremony After Dinner Speaker: Fred Felleman, *Ecology of Puget Sound Killer Whales*

Friday, March 17 - General Meeting

8:00 – Noon	Concurrent Sessions 1. Conservation Planning Initiatives in the Pacific Northwest 2a. Wildlife and Forests Management 2b. Miscellaneous Topics in Wildlife

Saturday, March 18 - Field Trips

9:00 – 2:00	The Bear River: Integrating Aquatic and Terrestrial Management in Watershed Restoration; Organizer, *James MacCracken*
8:00 – 2:30	Wetland, Stream and Terrestrial Amphibians; *Organizer, Larry Jones*
11:00 & 2:00	Whale Watching Boat Trip (if you haven't pre-registered, check at registration desk upon arrival at meeting for seating availability); *Organizer, Janet Jones*

Wednesday 15 March 2000

Plenary Session:
Integrating Aquatic and Terrestrial Vertebrate Research and Management

1:00 – 1:10	INTRODUCTION AND WELCOME TO THE MEETING, Greg Green, SNVB president, and Bill Gaines, Washington Chapter TWS President
1:10 – 2:10	Keynote Speaker: Jeff Cederholm, Washington Department of Natural Resources. PACIFIC SALMON AND WILDLIFE: ECOLOGICAL CONTEXTS, RELATIONSHIPS, AND IMPLICATIONS FOR MANAGEMENT
2:10 – 2:50	Boone Kauffman, Department of Fisheries and Wildlife, Oregon State University. DIVERSITY AND DYNAMICS OF RIPARIAN ECOSYSTEMS--WHY RESTORATION AND PRESERVATION MATTERS
2:50 – 3:10	*Break*
3:10 – 3:50	Barb Beasley, Long Beach Model Forest Society. FOREST PRACTICES AND AMPHIBIANS IN CLAYOQUOT SOUND
3:50 – 4:30	Terry Wahl, Unaffiliated. ECOLOGY OF SEABIRDS OFF OREGON AND WASHINGTON
4:30 – 5:10	Greg Green, Parametrix, Inc. THE CETACEANS OF OREGON AND WASHINGTON

Thursday 16 March 2000 *Morning Concurrent Session #1*

Aquatic and Terrestrial Species Interactions
Moderator - David H. Johnson

8:20 - 8:40	COASTAL CUTTHROAT TROUT: THEIR BIOLOGY, STATUS, AND THE EVOLUTION OF OUR UNDERSTANDING. Garrett, Ann M.
8:40 - 9:00	DISTRIBUTION OF JUVENILE COHO SALMON IN RELATION TO WATER TEMPERATURES IN TRIBUTARIES OF A NORTHERN CALIFORNIA WATERSHED: DETERMINING MANAGEMENT THRESHOLDS FOR AN IMPAIRED COLD-WATER ADAPTED FAUNA. Welsh, Hartwell H. Jr., Garth R. Hodgson, Maureen F. Roche, and Bret C. Harvey.
9:00 - 9:20	EXPERIMENTAL TEST OF NON-NATIVE FISH EFFECTS ON MOUNTAIN YELLOW-LEGGED FROGS: HOPE FOR AMPHIBIAN RECOVERY? Vredenburg, Vance T.
9:20 - 9:40	CASPIAN TERN MANAGEMENT IN THE COLUMBIA RIVER ESTUARY. Craig, David P., Daniel D. Roby, Donald E. Lyons, and Ken Collis.
9:40 - 10:00	*Break*
10:00 - 10:20	POTENTIAL EFFECTS OF TROUT STOCKING ON INVERTEBRATES AND SALAMANDERS IN WASHINGTON HIGH LAKES. Pfeifer, Bob.
10:20 - 10:40	BULL TROUT: BIG BEAUTIFUL FISH IN SMALL PRISTINE WATERS. Spalding, Shelley.

Wildlife Conservation

Moderator – Rebecca Thompson

1:00 – 1:20	STATUS OF WASHINGTON'S PYGMY RABBIT - RECOVERY OF AN ENDANGERED SPECIES - WORK IN PROGRESS. Musser, John L., and Tom McCall.
1:20 – 1:40	THE ESTABLISHMENT OF A NEW SUBPOPULATION OF COLUMBIAN WHITE-TAILED DEER. Brookshier, Jennifer S., Alan C. Clark, and Thomas M. Kollasch.
1:40 – 2:00	PHYLOGEOGRAPHY OF ERMINE (*MUSTELA ERMINEA*) AND MINK (*MUSTELA VISON*) OF THE NORTH PACIFIC COAST. Fleming, Melissa, and Cook, Joseph.
2:00 - 2:20	INLAND MARBLED MURRELET SURVEYS: WESTERN OLYMPIC PENINSULA, WA. Horton, Scott, Peter Harrison, and Elena Kuo-Harrison.
2:20 - 2:40	GEOGRAPHIC STRUCTURE TO COMMON MURRE POPULATIONS FROM BRITISH COLUMBIA TO CALIFORNIA. Warheit, Kenneth I., Vicki L. Friesen, and Tim P. Birt.
2:40 – 3:00	*Break*
3:00 - 3:20	A SURVEY PROTOCOL FOR BURROWING OWLS IN THE COLUMBIA BASIN. Bartels, Peggy, and Jim Tabor.
3:20 - 3:40	STATUS OF THE BREEDING POPULATION OF GREATER SANDHILL CRANES IN WA. Engler, Joseph D., and Eric D. Anderson.
3:40 - 4:00	SEASONAL FECUNDITY AND NESTING SUCCESS OF SHRUB-STEPPE PASSERINES IN ALTERED LANDSCAPES. Vander Haegen, W. Matthew.
4:00 - 4:20	TRENDS IN SPOTTED OWL AND BARRED OWL DETECTIONS IN THE OLYMPIC EXPERIMENTAL STATE FOREST FROM 1991 TO 1999. Wiedemeier, Douglas J., and Horton, Scott P.
4:20 - 4:40	RAPTOR MONITORING ALONG THE OUTER COAST OF WASHINGTON, 1995-1999. Varland, Daniel E., and Jack L. DeLap

Thursday 16 March 2000 *Afternoon Concurrent Session #2*

Riparian Amphibians

Moderator – Bruce Bury and Elke Wind

1:00 – 1:20	HABITAT SEGREGATION OF TWO AMBYSTOMATIDS IN MOUNTAIN PONDS, MOUNT RAINIER NATIONAL PARK. Brokes, Brendan J.
1:20 – 1:40	DIEL PATTERNS OF SURFACE ACTIVITY AND MICROHABITAT USE BY STREAM-DWELLING AMPHIBIANS IN THE OLYMPIC PENINSULA. Jones, Lawrence L. C., and Martin G. Raphael.

1:40 – 2:00	TEMPORAL AND SPATIAL VARIABILITY IN THE ABUNDANCE OF TAILED FROG TADPOLES (*ASCAPHUS TRUEI*) IN A NORTHERN IDAHO WATERSHED. Lohman, Kirk.
2:00 - 2:20	WATERSHED-LEVEL DISTRIBUTIONS OF STREAM AMPHIBIANS IN THE BLUE RIVER WATERSHED, WEST-CENTRAL CASCADES OF OR. Hunter, Matthew G.
2:20 - 2:40	STREAM VERTEBRATES IN MANAGED HEADWATER STREAMS: HABITAT ASSOCIATIONS OF ASSEMBLAGES AND SPECIES. Olson, Deanna H., George W. Weaver, Loretta L. Ellenburg, Bruce Hansen, and Rebecca Thompson.
2:40 – 3:00	*Break*
3:00 - 3:20	SAMPLING DESIGNS FOR AQUATIC VERTEBRATES IN MANAGED HEADWATER STREAMS. Weaver, George W., Deanna H. Olson, Loretta L. Ellenburg, and Bruce P. Hansen.
3:20 - 3:40	DEMOGRAPHICS AND AGE AT METAMORPHOSIS OF LARVAL TAILED FROGS, ASCAPHUS TRUEI, IN A COASTAL OREGON STREAM. Hansen, Bruce P., Deanna H. Olson and Christopher D. Moyer.
3:40 - 4:00	EFFECTS OF TAILED FROG TADPOLE DENSITY ON TADPOLE GROWTH, INVERTEBRATE ABUNDANCE, AND ALGAL ABUNDANCE. Rundio, David E., and Charles P. Hawkins.
4:00 - 4:20	OREGON SPOTTED FROG (*RANA PRETIOSA*) OVIPOSITION: CONSERVATION IMPLICATIONS. Hayes, Marc P., and Engler, Joseph D.
4:20 - 4:40	ESTIMATION OF DAILY SURVIVAL RATES OF *HYLA REGILLA* TADPOLES IN THE WILD. Govindarajulu, Purnima.
4:40 – 5:00	PALATABILITY OF SOUTHERN TORRENT SALAMANDER LARVAE TO PACIFIC GIANT SALAMANDER LARVAE. Rundio, David E., and Deanna H. Olson.

Thursday 16 March 2000 *Evening Poster Session*

Poster Session

8:00 – 5:00; Open viewing
5:00 – 6:00; *Authors of posters will be present at this time*

EVIDENCE OF *BRUCELLA* SP. INFECTION IN PACIFIC HARBOR SEALS (*PHOCA VITULINA RICHARDSII*) AND CALIFORNIA SEA LIONS (*ZALOPHUS CALIFORNIANUS*) FROM WASHINGTON. Lambourn, D.M., Jeffries, S.J., Huber, H.R., Gearin, P.J., Hughes, K.M., Garner, M.M., Ewalt, D.R., Rhyan, J.C.
DIET OF COMMON MURRES (*URIA AALGE*) COLLECTED ON THE NORTHERN OUTER COAST OF WASHINGTON, SUMMER 1997. Wilson, Monique L., and Christopher W. Thompson
ABUNDANCE OF PLASTIC DEBRIS AND INGESTION BY ALBATROSS ON KURE ATOLL, NORTHWESTERN HAWAIIAN ISLANDS. Irene Kinan
SATELLITE TELEMETRY STUDIES OF BALD EAGLES IN WASHINGTON STATE. James W. Watson

SAMPLING FOR SURVEY AND MANAGE SPECIES IN THE CASCADE MOUNTAINS OF WASHINGTON. Rand, G., M. Hall, K. Engel, and R. Fairbanks
AMPHIBIAWEB: AN INFORMATION SYSTEM FOR AMPHIBIAN CONSERVATION BIOLOGY. Mahoney, Meredith J., Vance T. Vredenburg, Joyce Gross, and David B. Wake
THE DISTRIBUTION AND MONITORING OF AMPHIBIANS ON AN INDUSTRIAL FOREST IN NORTHERN IDAHO. Heglund, Patricia J., Hamilton, Graham B., Charles R. Petersen, and William A. Wall
FORAGING ECOLOGY OF HARBOR SEALS IN HOOD CANAL AND THE POTENTIAL IMPACTS ON THREATENED SALMONID STOCKS. London, Josh M., Wilson, Monique L., and Jeffries, Steve J.
THE TRUTH ABOUT SCIENCE. Kelsey, Kathryn A., and Ashley Steel
MONITORING THE IMPACTS OF FOREST PRACTICES ON ECOSYSTEMS OF THE WEST COAST OF VANCOUVER ISLAND. Beasley, B., Marshall A., and McGarvie, J.
ENDEMIC FAUNA OF THE OWYHEEAN ISLANDS OFF THE COAST OF IDAHO: SPECIATION AND EVOLUTION FROM MILLENNIAL STIMULATION Jones, Lawrence L. L. L. C., Janet L. L. Jones, Uncle Nardly, J. Jay, Barnabas Zokvinov, and Iolanthe.

Friday 17 March 2000 *Morning Concurrent Session #1*

Conservation Planning Initiatives in the Pacific Northwest
Moderator – Craig Hansen

8:20 – 8:40	CONSERVATION PLANNING UNDER THE ESA: POLICIES AND APPROACHES. Hansen, Craig A.
8:40 – 9:00	PLUM CREEK'S CENTRAL CASCADES HABITAT CONSERVATION PLAN: THIRD YEAR PROGRESS REPORT. Hicks, Lorin L., and Henning C. Stabins.
9:00 - 9:20	THE FAMILY FOREST CONSERVATION PROJECT. Stinson, Steve
9:20 - 9:40	HCPS IN THE NORTHWEST: MISSED OPPORTUNITIES FOR IMPROVED ENDANGERED SPECIES CONSERVATION. Cullinan, Tim
9:40 – 10:00	*Break*
10:00 - 10:20	WASHINGTON STATE LANDOWNER LANDSCAPE PLANS. Whipple, David..
10:20 - 10:40	THE WASHINGTON LANDOWNER LANDSCAPE PLAN PILOT PROGRAM FROM THE LANDOWNERS PERSPECTIVE. MacCracken, James G.
10:40 - 11:00	WHAT IS KNOWLEDGE WORTH?: ADAPTIVE MANAGEMENT IN HABITAT CONSERVATION PLANS. Wilhere, George, F.
11:00 – 11:20	FIRST HCPS, THEN NO SURPRISES, WHAT'S NEXT? Vogel, William O.
11:20 - 12:00	PANEL DISCUSSION

Wildlife and Forests Management (8:00 – 10:40)
Miscellaneous Topics in Wildlife (10:40 – 11:40)
Moderator – Cay Ogden

8:00 – 8:20	THE HISTORY BEHIND THE NORTHWEST FOREST PLAN SURVEY AND MANAGE PROVISIONS. Ogden, Cay.
8:20 – 8:40	THE OLYMPIC NATIONAL FOREST'S EXPERIENCE AND OBSERVATIONS OF IMPLEMENTING THE SURVEY AND MANAGE PROGRAM. O'Halloran, Kathy
8:40 – 9:00	NORTHWEST FOREST PLAN SURVEY AND MANAGE ISSUES AND TRANSPORTATION PROJECTS: A CASE STUDY FROM SR12 WHITE PASS IN THE GIFFORD PINCHOT NATIONAL FOREST. Jorgensen, Kelley. K.
9:00 - 9:20	FOREST FRAGMENTATION: WILDLIFE AND MANAGEMENT IMPLICATIONS. Rochelle, James A.
9:20 - 9:40	FOREST MANAGEMENT FOR SPOTTED OWLS ON RAYONIER LANDS OF THE OLYMPIC PENINSULA: THE WILDLIFE PLAN AREA. Varland, Daniel E.
9:40 – 10:00	*Break*
10:00 - 10:20	PRELIMINARY ASSESSMENT OF BLACK BEAR HABITAT USE OF INTENSIVELY MANAGED FOREST LANDSCAPES IN WESTERN WASHINGTON. Nyland, Philip D., and G. M. Koehler.
10:20 - 10:40	RESPONSES OF SMALL MAMMAL POPULATIONS TO RIPARIAN BUFFERS IN WESTERN WASHINGTON. West, Stephen D.
10:40 – 11:00	PHEASANT BROOD AND CROW SURVEYS: WHAT GOOD ARE THEY. Rice, Clifford G., and D. Ware.
11:00 - 11:20	OBSERVATIONS OF SHARP-TAILED SNAKES (*CONTIA TENUIS*) IN OREGON. Hoyer, Richard F., Mason, Robert T., LeMaster, Michael P., Moore, Ignacio.
11:20 - 11:40	HOW RATTLESNAKES RATTLE. Moon, Brad R., William Kemper, Kevin E. Conley, Lynn Hartzler, and James H. Hicks.

ABSTRACTS

Aubry, Keith B[1]., and Angela B. Stringer[2]. **Field test of the SMED, a small mammal escape device for pitfall trapping amphibians.** [1]USDA Forest Service, PNW Research Station, Olympia, WA, and [2]Univ. of Washington, College of Forest Resources, Seattle, WA.

Pitfall trapping is the most efficient and cost-effective method for sampling amphibians in PNW forests. However, institutional animal care committees are increasingly reluctant to approve research projects that use this technique, because large numbers of mammals are also captured during trapping, and subsequently die by drowning. To enable researchers to use this technique to study amphibians, we designed a pitfall trap insert that would allow small mammals to escape while retaining amphibians. To test the effectiveness of our design in both single- and double-deep pitfall traps, we installed 6 x 6 pitfall arrays in 8 forested sites in southwestern Washington. Each grid contained 18 single- and 18 double-deep pitfall traps in a checkerboard arrangement; half of each trap type contained SMEDs and the other half did not. We opened traps from 17 October 1997 to 9 January 1998, capturing 273 amphibians and 110 mammals. SMEDs were extremely effective in allowing small mammals to escape; significantly fewer individuals were captured in both single- (5/48) and double-deep (2/62) traps with SMEDs. However, SMEDs also enabled many amphibians to escape; we only captured 68/273 amphibians in traps with SMEDs, and differences were significant for both single- and double-deep traps. We found no differences in total captures of amphibians or small mammals in single-deep vs. double-deep traps (with or without SMEDs) indicating that double-deep traps are unnecessary. Although the use of SMEDs should enable researchers to obtain approval for sampling amphibians with pitfall traps, either the number of traps or the number of trapnights will need to be increased substantially to obtain an adequate sample size.

Aubry, Keith B., and Catherine M. Raley. **The pileated woodpecker as a keystone habitat modifier in the PNW.** USDA Forest Service, PNW Research Station, Olympia, WA.

We propose that the pileated woodpecker (*Dryocopus pileatus*) is a keystone habitat modifier in the PNW. It is the largest woodpecker in this region and the only species that forages primarily by excavating; only pileateds are capable of creating large cavities in hard snags and decadent live trees. A wide array of species, including many that are of management concern in the PNW, use old pileated nest and roost cavities. In addition, pileateds provide foraging opportunities for other species, accelerate decay processes and nutrient cycling, and may facilitate inoculation by heart-rot fungi and mediate insect outbreaks. Because of the potential keystone role of pileated woodpeckers in PNW forests, we recommend that their habitat needs be afforded special attention in forest management plans and monitoring activities.

Bartels, Peggy, and Jim Tabor. **A Survey Protocol for Burrowing Owls in the Columbia Basin.** Washington Dept. of Fish and Wildlife, Ephrata, Washington

The burrowing owl (*Speotyto cunicularia*) population is thought to be declining in Washington state and is listed as a Species of Concern by the Washington Dept. of Fish and Wildlife (WDFW). Survey techniques are needed to monitor trends in the burrowing owl population. A roadside survey protocol for detecting burrowing owls was tested on 33 routes during the spring and summer of 1999 in the Columbia Basin of Washington, (Adams, Grant, Douglas, Franklin, Lincoln, and Okanogan Counties). As part of the nationwide survey effort, WDFW designed the survey methodology used during this survey. Owls were detected along 14 of the 33 routes. Owls were detected both before and after broadcasting burrowing owl songs. Using the auditory stimulus increased the overall owl detection rate by 25%. Along routes where more than one occupied burrow was detected and a playback tape was broadcast, the owl detection rate increased to 58%. The use of auditory calls is recommended as a tool to increase the detection rate of owls. Ecology of the Columbia Basin (Adams, Douglas, Grant, Franklin, Lincoln, and Okanogan Counties) geographic population is largely unrecorded. Nest abandonment was detected along 25% of the roadside routes. Productivity measured 7.8 owlets per nesting burrow in 1990 and 1.8 owlets per nesting burrow in 1999. Bats, marmots, birds and ground squirrels were found in the regurgitated owl pellets. A survey conducted in 1990 within 38 townships in Grant County was repeated in 1999 and found at least a 13% decline and a 5% reduction in burrowing owl range. Future studies will be conducted during the next 3 years by WDFW and Washington State Univ.

Beasley, B., Marshall A., and McGarvie, J. **Monitoring the impacts of forest practices on ecosystems of the West coast of Vancouver Island**. Long Beach Model Forest Society, Ucluelet, B.C. *(Poster)*

The Long Beach Model Forest (LBMF) is part of a national program created to promote sustainable forest management. One of our goals is to develop criteria and indicators to monitor the impacts of forest practices on ecosystems. Inventory projects have focused on determining local level indicators of biological diversity in wetlands, hydroriparian areas of headwater streams, and interior old growth forests. Ongoing research involves monitoring the effectiveness of hydroriparian reserves, helicopter cedar salvage practices, slope restoration techniques and other recommended methods of sustainable ecosystem management in Clayoquot Sound.

Betts, Burr J., Anthony J. Stefano, and Sherri D. Wagner. **Responses of Little Brown and Townsend's Big-Eared Bats to Microclimate Changes in Maternity Roosts.** Eastern Oregon Univ., La Grande, OR.

Microclimatic variables are important determinants of whether a site is appropriate as a roost location for maternity colonies of bats, and our understanding of such determinants is important as we look for ways to protect bat populations. A maternity colony of about 100 female Townsend's big-eared bats (*Corynorhinus townsendii*), a species of concern in western North America, and a colony of about 1000 little brown bats (*Myotis lucifugus*) were located in opposite ends of the attic of a ranch building in the Blue Mountains east of Pendleton, Oregon. The colonies were videotaped for continuous 24-hour periods once per week from mid-June until mid-August. On-the-hour, each colony was scanned to provide information on the size and location of individual groups. Data loggers were used to record temperature, relative humidity, and light intensity at various locations in the attic and outside the building. The big-eared bats appeared to respond to increasing temperature by moving down the slope of the roof, moving from the south to north side of the building, and dividing into smaller groups. The response of little brown bats to increasing temperature was much less apparent, with most bats remaining near the peak. We will discuss statistical analysis of how these movements of the two colonies were affected by the microclimatic variables.

Brokes, Brendan J. **Habitat Segregation of Two Ambystomatids in Mountain Ponds, Mount Rainier National Park.** Oregon State Univ., Corvallis, OR, and Mount Rainier National Park, Ashford, WA.

Ambystoma macrodactylum (long-toed salamander) and *A. gracile* (northwestern salamander) are two common salamander species occupying key trophic positions in mountain ponds of Mount Rainier National Park. Field observations of fishless ponds in the northeast quadrant of the park suggested that populations of these two species were typically allopatric, but were sympatric in a few ponds. In most cases the long-toed salamander inhabited shallow ponds (<1m) with consolidated sediments whereas the northwestern salamander inhabited deep ponds (>1m) with flocculent organic bottom sediments. Differences in habitat characteristics between these two *Ambystoma* species were investigated and distinct habitat associations were found for each species. Differences in pond area, depth, elevation, and the organic content of bottom sediments influenced their distributions and abundances. Furthermore, the abundance of coarse woody debris and aquatic vegetation played a role in habitat partitioning by the two species in ponds supporting sympatric populations. Predictive models were developed, which may aid in the development of future management decisions in the park and elsewhere in the Cascade Mountains.

Brookshier, Jennifer S., Alan C. Clark, and Thomas M. Kollasch. **The establishment of a new subpopulation of Columbian white-tailed deer**. U.S. Fish and Wildlife Service, Julia Butler Hansen Refuge for the Columbian White-tailed Deer, Cathlamet, WA.

Recovery of the lower Columbia River population of the endangered Columbian white-tailed deer (*Odocoileus virginianus leucurus)* has been hampered by a lack of secure habitat and limited range. In 1999, 30 deer were translocated to a Columbia River island in an effort to establish a new subpopulation within the deer's historical range. Deer were captured from two nearby subpopulations. Post-capture mortality was low and the majority of deer remain either on or near the island. Thirty more deer will be moved in 2000. The establishment of this new subpopulation will be a major step towards recovery of the deer.

Brown, Timothy K. **Ecology and maintenance of wildlif e trees and logs.** Timothy K. Brown. Bellevue WA.

Hazard trees provide unique habitat for a great diversity of wildlife. We recommend retention of certain physical characteristics of hazard trees in order to maintain their role as wildlife trees. Rather than removal of the entire tree during harvest operations, we recommend shortening these trees to a safe height and subsequent sculpturing into natural looking broken tops. Natural aesthetics around campgrounds, historical buildings bridges, and parks can be maintained by using these techniques. Modifying snags to reduce safety hazards while still providing some snag habitat is aesthetically pleasing and conserves wildlife values. Individual trees can be enhanced for wildlife with the addition of cavities for mammals, insects and birds. Snag tree retention and habitat improvement techniques for bats, small mammals, bears, birds and pollinating insects are presented.

Bury, R. B., M.J. Adams, and P. Loafman. **Stream Amphibians in Olympic National Park: Confirmations and Surprises in Distribution and Abundance Patterns.** USGS Forest and Rangeland Ecosystem Science Center, Corvallis, OR.

In 1996-98, we determined the distribution and relative abundance of stream amphibians in 12 of the 13 river basins in Olympic National Park (ONP). We surveyed 142 streams (employing 10 1-m random belts/site) and 244 seeps (50% of area or 15 min/site). Tailed frogs were widespread and common; cobble substrate was a key predictor of its occurrence. Olympic salamanders were widespread and fairly common, but only present at a few sites in the NE portion of ONP; they preferred steep, shallow waters (especially seeps) with cobble substrate. Cope's giant salamander was a habitat generalist and common in ONP—except we found none in the NE corner where the climate is warmer and drier than the rest of ONP. However, it is unclear how climate influences the occurrence of Cope's giant salamander. All of these stream amphibians appear to be sensitive to elevated temperatures and, thus, may prove to be indicator species for studies of global climate change.

Craig, David P.[1], Daniel D. Roby[1], Donald E. Lyons[1], and Ken Collis[2] **Caspian Tern Management in the Columbia River Estuary.** [1]Oregon Cooperative Fish and Wildlife Research Unit, Oregon State Univ., Corvallis, OR; [2]Real Time Research, Bend, OR.

The Caspian tern colony on Rice Island, an artificial dredged material island in the Columbia River estuary, is the largest of its kind in the world. This tern population consumed about 10.8 million juvenile salmonids, or approximately 11% of the out-migrating smolts that reached the Columbia River estuary in 1998. In 1999 we attempted to relocate part of the Rice Island tern colony (rivermile 21) to East Sand Island (rivermile 5). After restoration of 8 acres of nesting habitat on East Sand Island, tern decoys, audio playback systems, and selective gull removal were used to encourage terns to nest on the new site. Concurrently, silt fencing was erected on 65% of the former tern colony site on Rice Island to further encourage terns to shift to East Sand Island. Despite greatly reduced colony area, about the same number of terns nested on Rice Island in 1999 as in 1998 (ca. 8,000 pairs). Rice Island terns continued to consume mostly young salmon (75% of prey). About 1,400 pairs of Caspian terns nested at the new colony site on East Sand Island, where approximately 1,600 -1,700 chicks were raised (more than twice the nesting success of terns nesting on Rice Island). Terns nesting on East Sand Island consumed 41% fewer salmonids than terns nesting on Rice Island.

Cullinan, Tim. **HCPs in the Northwest: missed opportunities for improved endangered species conservation.** National Audubon Society, Washington State Field Office. Olympia, WA

The Endangered Species Act is flawed because Section 9 take prohibitions apply only to individual organisms and to occupied habitat. Consequently, prohibition of take achieves only short-term conservation on a local scale. Habitat Conservation Plans (HCPs) offer opportunities to successfully manage listed species over larger temporal and spatial scales. Most HCPs in the Northwest have failed to capitalize on these opportunities. HCP implementation can be improved by earlier involvement of scientists, and of the public, and by more rigorous conservation planning and assessment of impacts at the metapopulation scale.

Davis, Theodore M.[1], and Kristiina E. Ovaska[2]. **Long-term monitoring of the Western Red-backed Salamander (*Plethodon vehiculum*) in Goldstream Park, southeastern Vancouver Island, British Columbia, Canada.** [1] Dept. of Biology, Univ. of Victoria, Victoria, B.C., Canada, [2] Biolinx Environmental Research Ltd., Victoria, B.C., Canada.

The Western red-backed salamander, *Plethodon vehiculum*, reaches remarkably high densities in Goldstream Park, Vancouver Island, BC. We studied the ecology of this population intermittently from 1984 to 1999. Based on searches of a 100 m^2 plot (plot A) in May 1984, the maximum surface density was 1.4 salamanders/m^2 (KO). Additional searches in five 1 m^2 quadrats randomly located in the surrounding area suggested that the number of salamanders in plot A was depressed later in the summer by a factor of 7 because of searched-induced habitat modification. Absolute abundance was determined in 1992 by census in 100 m^2 fenced plots near Lake Cowichan, BC (TD). The maximum number of salamanders found on the surface at any time was less than 24% of the animals in the plot, and on average, only about 10% of the population could be located on the surface during times of peak activity. Based on quadrat searches in Goldstream Park, the peak surface density of *P. vehiculum* in 1994 was 1.8 salamanders/ m^2, but density varied by a factor of 72 over a distance of 200 m. From September 1997 to May 1999, we monitored the Goldstream population both with coverboards and quadrat searches. Quadrat searches yielded 3.7 salamanders/m^2, which suggests an absolute density of 65,000 – 70,000 salamanders/ha. This is the highest density reported for any salamander in North America. Based on both coverboard and quadrat searches, relative abundance increased from 1984 to 1992 and from 1992 to 1999.

Engler, Joseph D., and Eric D. Anderson. **Status of the Breeding Population of Greater Sandhill Cranes in Washington.** U.S. Fish and Wildlife Service, Ridgefield National Wildlife Refuge Complex, Ridgefield, WA

Greater sandhill cranes were once considered a common breeding species in Washington, however, the population declined to near extinction during the 20th century. Intensive surveys were initiated in 1995 in areas of known summer occurrence within Klickitat and Yakima Counties. Ground and aerial surveys, nest monitoring and color-marking during the past five years has provided valuable knowledge of the crane's current status in the state. While the nesting population of cranes exhibits excellent production, it remains small, suggesting regional and state-wide habitat limitations or other unknown factors may be impacting the recovery of this State-endangered subspecies.

Fleming, Melissa A.[1], and Cook, Joseph A.[2] **Phylogeography of ermine (*Mustela erminea*) and mink (*Mustela vison*) of the North Pacific Coast.** [1]Fred Hutchinson Cancer Research Center, Seattle, WA and [2] Univ. of Alaska Museum, Fairbanks, AK.

The North Pacific Coast (NPC) of North America is a highly fragmented landscape with a complex glacial history and high levels of mammalian endemism. Seven subspecies of ermine and two subspecies of mink are endemic to the region and are considered 'potentially threatened' by the IUCN. We sequenced the cytochrome b gene (ermine and mink) and control region (mink) of mitochondrial DNA to determine the role of glacial refugia in generating subspecific diversity. Ermine (210) and mink (35) were sampled across the species range, but primarily in Alaska and British Columbia. We identified three divergent (>2%) lineages of ermine on the NPC. One is distributed from Alaska to Eurasia and another from Alaska to New Mexico and Wisconsin. The third appears restricted to the southernmost islands of SE Alaska and Haida Gwaii, B.C. In contrast, mink show little (<1%) mtDNA divergence from Alaska to Arkansas, including NPC island endemics. Mink appear to have expanded post-glacially from a single, southern refugium and diverged *in situ* on the NPC. High ermine diversity is attributable in part to colonization from three distinct refugia: Beringia, south of the ice sheets, and possibly a coastal refugium on the NPC. Additional sampling from B.C. and the PNW should elucidate the origin of the third ermine lineage.

Flick, C.J., and D.C. Shaw. **Vertical and seasonal occurrence of Douglas' squirrel, *Tamiasciurus douglasii*, in an old-growth Douglas-fir/western hemlock forest.** USDA Forest Service, Gifford Pinchot National Forest, Carson, WA, Wind River Canopy Crane Research Facility, Univ. of Washington, Carson, WA.

The Douglas' squirrel, *Tamiasciurus douglasii*, was surveyed weekly for its occurrence in the canopy of an old-growth Douglas-fir/western hemlock forest from March 1996 to March 1999 using the Wind River Canopy Crane to determine vertical and seasonal use. The canopy was divided into three equal zones, low (0-20 m), mid (20-40 m) and upper (40-60+ m). Douglas' squirrels were surveyed by sight or sound from the gondola of the crane in each zone and in four cardinal directions, resulting in 12 survey plots for each weekly survey visit. Plots were 30 m in radius and lasted five minutes after a three minute quiet down. Seasonally, the Douglas' squirrel was most commonly detected during August, September, October and November, averaging over 1.5 squirrels per survey visit during these months. The remainder of the year, detections averaged about 0.5 or less squirrels per survey visit. For the entire survey period, squirrels were detected about 20% in the upper canopy, 25% in the mid canopy, and 55% in the lower canopy. There was a strong seasonal pattern of use in the mid and upper canopy. Squirrels were detected in the upper canopy most often during July - November when cones were maturing and opening. During winter and early spring, squirrels were uncommon in the mid and upper canopy. The Douglas' squirrel appears to be a squirrel of the lower canopy, except when food resources are abundant in the higher vertical zones.

Fraker, Mark A.[1],and Ian Robertson[2]. **Recent Observations on the Small Mammal Fauna of Burns Bog, British Columbia.** [1]TerraMar Environmental Research Ltd., Sidney, BC CANADA; [2]Robertson Environmental Services Ltd., Langley, BC CANADA

From late August to early October 1999, we studied the small mammal fauna (insectivores, small rodents, hares and rabbits, and small mustelids) of Burns Bog, British Columbia (BC), the largest (4 000 ha) remaining wildland in the greater Vancouver area. Using snap traps, live traps, and pitfall traps, we expended >3600 trap-nights of effort distributed among nine habitat types; trapping information was supplemented by observations and by small mammal remains from Barn Owl *(Tyto alba)* pellets. We documented the presence of 14 species. Two of these, (Pacific Water Shrew, *Sorex bendirii,* and Southern Red-backed Vole, *Clethrionomys gapperi occidentalis),* are on the BC Red List (= endangered). Another, Trowbridge's Shrew *(Sorex trowbridgii),* is on the Blue List (= threatened). Prior to this study, the Southern Red-backed Vole, *occidentalis* subspecies, was known in BC from only 2 specimens, the most recent collected >50 years ago. Deer Mice *(Peromyscus manaiculatus)* were the most common species captured, followed by Vagrant Shrews *(S. vagrans),* Dusky Shrews *(S. monticolus),* a Common Shrew *(S. cinereus),* and 2 Creeping Voles *(Microtus oregoni).* Remains of Ermine *(Mustela erminea)* and Shrew Mole *(neurotrichus gibbsi)* came from owl pellets. We also saw Douglas Squirrels *(Tamiasciurus douglasii).* Reliable observations by co-workers added Eastern Cottontail *(Sylvilagus floridanus),* Northern Flying Squirrel *(Glaucomys sabrinus),* and Pacific Jumping Mouse *(Zapus princeps).* We found no evidence of the Red-listed Snowshoe Hare *(Lepus americanus washingtonii)* or Long-tailed Weasel *(Mustela frenata altifrontalis),* species believed to have lived in the bog formerly.

Garrett, Ann M. **Coastal cutthroat trout: Their biology, status, and the evolution of our understanding.** Parametrix, Inc., Kirkland, WA

In fresh water, coastal cutthroat trout *(Oncorhynchus clarki clarki)* may appear more ubiquitous than most salmon and trout species in the PNW. Although their numbers are not abundant relative to other *Oncorhynchus* species, they occupy a wide range of freshwater habitats, from small streams to large rivers, lakes, and ponds. Frequently, cutthroat trout are the only salmon found in first and second-order headwater streams. Lower in the basin they live in sympatry with other salmon species. Migratory individuals may range the extent of the basin, and even migrate to sea. But their reliance on freshwater habitat for most or all of their life increases their risk from land use practices that interrupt migratory corridors and alter habitat. Research suggests that large woody debris may influence their abundance more than any other habitat variable, and that land management practices, like logging, may have long lasting negative effects on cutthroat trout abundance. Nonetheless, cutthroat trout occupy some vastly altered habitats, including some highly urbanized basins where they have become the predominant salmonid. I will explore some reasons for this seemingly contradictory information, including the role that different life-history forms and sympatric *Oncorhynchus* species may play. I will briefly discuss what makes coastal cutthroat trout distinct from the other salmon

species, their status under the Endangered Species Act, and how our understanding of this complex species has grown considerably in just the last few years and continues to evolve. Successful management of cutthroat trout requires an ecosystem approach, committed to maintaining connected freshwater habitats, and adaptive enough to keep pace with our changing understanding of the species.

Govindarajulu, Purnima. **Estimation of daily survival rates of *Hyla regilla* tadpoles in the wild.** Univ. of Victoria, Victoria, BC, Canada.

I estimated daily survival rate of Pacific tree frog (*Hyla regilla*) tadpoles using mark-recapture methods during three weeks of the early summer of 1999, in Victoria, British Columbia. Tadpoles were marked by an elastomere paint injection to the top of the tail fin and recaptured every two days. Computer intensive methods were used to derive maximum likelihood estimators of survival rates. Survival rate of tadpoles (*Hyla regilla)* in a pond with non-native bullfrog (*Rana catesbeiana*) tadpoles is compared to their survival rate in a pond with out this introduced species. The average daily survival rate for *Hyla regilla* tadpoles in the two ponds was not significantly different (0.91 ± 0.01 with out bullfrog tadpoles compared 0.88 ± 0.01 with bullfrog tadpoles) (mean $\pm$ std.err). The size of the tadpoles was similar in the two ponds except in the latter Gossner development stages, when the tadpoles in the pond without bullfrogs seemed to be larger, and faster in their development compared to pond with bullfrog tadpoles. Other than the presence of introduced bullfrogs, the taxonomic composition of the aquatic community was similar in the two ponds, but the relative abundance of the constituent taxa was significantly different. The advantages and disadvantages of studying competitive interaction between tadpole species in the field will be compared to those of controlled experimental studies in artificial ponds.

Hansen, Bruce P., Deanna H. Olson and Christopher D. Moyer. **Demographics and age at metamorphosis of larval tailed frogs, Ascaphus truei, in a coastal Oregon stream.** PNW Research Station, USDA, Forest Service, Corvallis, OR.

Tailed frog larvae (*Ascaphus trueii*) can be a major component of coastal stream communities, dominating many areas, especially riffles. Studies were initiated in 1998 to examine the demography of the larval population and methods for studying larval life history. Larval tailed frogs were sampled monthly, for 18 months, within the Schooner Creek basin, Lincoln Co., Oregon. Samples were collected in mainstem (5th order), tributary (4th order) and 2nd order headwater reaches. Total length, weight and developmental stage were recorded for each capture. Location within the basin influenced total abundance, as measured by catch per unit effort, and relative abundance of developmental stage. Age at metamorphosis was the same in all reaches. Using two summer samples across two years, and measures of total length, hind leg length and developmental stage, Bury and Adams, Herpetologica, 55(2). 1999. 283-291, determined Schooner Creek tailed frogs to have a two-year larval period. Our data, based on a different sampling protocol, indicate a one or a two-year larval period with metamorphosis in late summer for most of the larval population. Hatching appeared to occur during the fall months. The use of developmental stage, length measurements, sampling frequency and intensity to assess tailed frog larval life history needs further development.

Hansen, Craig A. **Conservation Planning under the ESA: Policies and Approaches.** U.S. Fish and Wildlife Service, Lacey, WA.

Several conservation-planning tools are available under the Endangered Species Act (ESA) for private landowners to meet the needs of species listed as threatened or endangered under the ESA, and as a means of managing their ownership resources with some flexibility for economic return. Habitat Conservation Plans have been the appropriate conservation tool for industrial forest landowners in Washington, and may well be necessary for large-scale agricultural management regimes. However, small landowners manage their ownerships under different conditions and constraints that may require the use of other conservation planning tools, such as Safe Harbor or Candidate Conservation Agreements made available by recently published policies. This presentation will discuss the operating Federal polices in the conservation planning arena under the ESA, the types of conservation planning tools available to private landowners, and how these policies are incorporated into private landowner conservation planning efforts.

Hawkes, Virgil. C., and Mark A. Fraker. **Observations of Amphibians in the Floodplain of a Regulated Northern River.** TerraMar Environmental Research Ltd. Sidney, BC.

In August 1999, we explored the effects of regulation of the Peace River, British Columbia (BC) on amphibians living in the floodplain. Because of regulation, high flows associated with the summer freshet no longer occur. We found Western Toad (*Bufo boreas*) adults and toadlets throughout our study area, while tadpoles were detected in only one location where reduced water temperatures may have retarded development. Wood Frogs *(Rana sylvatica)* were detected only at the western and eastern ends of the study area. Northern Chorus Frogs (*Pseudacris triseriata*), Long-toed Salamanders (*Ambystoma macrodactylum*), and Columbia Spotted Frogs (*Rana luteiventris*) were not detected, but they were detected at one location in August 1975. We identified areas of suitable breeding habitat within the floodplain of the Peace River, such as vegetated wetlands and temporary pools. Pre-impoundment conditions, and an emergency spill in 1996, would have precluded breeding in many habitats where toads bred in 1999. Thus, regulated flows have probably created a more favourable condition for amphibians. Although a spill of similar magnitude may impact amphibians using the floodplain of the Peace River, the temporal effects appear to be short-lived, at least for Western Toads. While we do not know the distribution of amphibians in the floodplain before 1996, Western Toads and Wood Frogs now occupy areas that were undoubtedly inundated during the 1996 spill. To accurately determine the distribution and species composition of amphibians breeding in the Peace River floodplain, surveys should be conducted during the spring breeding season.

Hayes, Marc P.[1], and Engler, Joseph D[2]. **Oregon spotted frog (*Rana pretiosa*) oviposition: Conservation Implications.** [1]Portland State Univ., Portland, OR; [2]Ridgefield National Wildlife Refuge Complex, Ridgefield, WA

Oviposition in the Oregon spotted frog *Rana pretiosa* was examined to identify patterns essential to its conservation at Conboy Lake National Wildlife Refuge (CLNWR), Washington state, USA. Oviposition began after the high water level in the seasonal lakebed was reached. Relatively rapid drop in water levels during the 20-day 1999 oviposition interval resulted in loss of >60% of the 5,400+ egg mass embryonic cohort to desiccation or stranding. Units in which functional dikes dampened the rate of water level drop, about 15% of the CLNWR area, had significantly higher survivorship. Ability to control water on CLNWR is generally limited either because the infrastructure for water-control is lacking or antiquated or the mosaic of private inholdings restricts water retention options. For these reasons, water management likely presents the most significant challenge affecting the Oregon spotted frog at CLNWR. Mortality from desiccation or stranding in 1998, thought to be similarly high to that observed in 1999, may be linked to the removal of at least one beaver dam on the lakebed drain in 1997. Oregon spotted frogs are postulated to be short lived, so mortality of much of the annual cohort in sequential years presents a potentially severe risk.

Heglund, Patricia J., Hamilton, Graham B., Charles R. Petersen, and William A. Wall. **The distribution and monitoring of amphibians on an industrial forest in Northern Idaho.** Potlatch Corporation, Lewiston, ID. *(Poster)*

Privately owned, industrial forests provide an excellent opportunity to examine relations between silvicultural management and resident amphibian populations. In northern Idaho, roughly 20% of the forest land is under industrial management. The mixed ownership (public and private), coupled with a mixture of even-aged and uneven-aged management has created a patchy mosaic of successional stages across the region. Current riparian zone best management practices for Idaho now require forest management agencies to leave a 30' buffer of forest on non-fish bearing streams and a 75' buffer on fish bearing streams. We conducted an inventory of 199 wetland areas, riparian zones and streams was conducted from 1994-1998 located within a 1.1 million hectare mixed ownership area in northern Idaho. Area-constrained surveys were used to sample ponds, seeps, cliffs and streams for the occurrence of amphibians. Seven of 10 species potentially occurring the area were recorded: long-toed salamander, Idaho giant salamander, tailed frog, Pacific tree frog, Columbia spotted frog, western toad, and Coeur d'Alene salamander. Habitat variables measured at each site in 1996 were used to create preliminary models explaining the occurrence of individuals species in relation to site characteristics. Additional sampling and habitat-relation model development will continue at a variety of scales. A randomized, long-term, sampling protocol will be implemented on a 3-year basis to monitor population trends of all 7 species of amphibians within the ownership.

Hicks, Lorin L., and Henning C. Stabins. **Plum Creek's Central Cascades Habitat Conservation Plan: Third Year Progress Report.** Plum Creek Timber Co., Seattle, WA.

Plum Creek's Central Cascades HCP was approved by the USFWS and NMFS in June, 1996. The HCP is a 50-year landscape plan for 169,000 acres of checkerboard ownership in the I-90 corridor, and addresses the habitat needs of 285 vertebrate species, including 5 federally listed species. In the 3 years since its inception, monitoring and research activities associated with the HCP have resulted in demographic data on 44 owl sites, fish-bearing and perennial status verification on 100 miles of stream, completion or near completion of 13 watershed analyses, and discovery of 2 vertebrate species not known to exist in the area prior to the HCP.

Horton, Scott, Peter Harrison, and Elena Kuo-Harrison. **Inland Marbled Murrelet Surveys: Western Olympic Peninsula, Washington.** Washington Dept. of Natural Resources (DNR), Forks, WA.

DNR is conducting inland surveys for Marbled Murrelets to develop an inventory of murrelet use of state forests in support of region-specific, long-term conservation strategies. Ongoing, extensive surveys began in 1996 in 16,800 ha of old-growth forest patches scattered across a commercial forest landscape. We identified 237 occupied (6,471 ha), 207 presence (5,110 ha), and 46 no detection (1,080 ha) sites. Types and numbers of murrelet detections varied with landscape-level characteristics of sites, and site-level characteristics of stations.

Hoyer[1], Richard F., Mason[1], Robert T., LeMaster[1], Michael P., Moore[2], Ignacio T. **Observations of Sharp-tailed Snakes (*Contia tenuis*) in Oregon.** [1]Dept. of Zoology, Oregon State Univ., Corvallis, OR; [2]Dept. of Zoology, Univ. of Washington, Seattle, WA.

In an ongoing study of the Sharp-tailed Snake (*Contia tenuis*), in Oregon, information has been gathered from locality records, a mark and recapture field study, and captive specimens. Because a second species of *Contia* is now known to occur in Oregon (Hoyer, in prep.), historical locality records include both species. The two species can be recognized by significant differences in relative tail lengths and the number of ventral and caudal scales present. The earliest museum and published records of *Contia* are from the 1930's in Jackson and Benton counties. *Contia* have now been recorded in one eastern, and eleven western Oregon counties with *C. tenuis* occurring in all but Curry and Coos Counties. The new species is believed to occur in all western Oregon counties from Lane County south. From March 1998 through January 2000, a total of 693 *C. tenuis* have been captured encompassing 544 initial and 149 recapture events. Sightings of *C. tenuis* have occurred in all months with major peaks of availability in March through May and in October through early November. Preliminary data suggest possible recognition of three age/size classes. Initial captures were composed of 322 combined subadult/adult snakes and 222 juveniles (10 months or less in age). Reliable sex determination was only possibly for the subadult and adult snakes in which males outnumbered females 178 to 144. Mean and maximum lengths for subadult/adult females exceeded those for males. Males have proportionately longer tails than females and greater number of caudal scales whereas females have a greater number of ventral scutes.

Hunter, Matthew G. **Watershed-level distributions of stream amphibians in the Blue River watershed, west-central Cascades of Oregon**. USFS PNW Research Station, Corvallis, OR.

Most recent research on stream amphibians has focused on associations with reach-level or stand-level environmental features. Little is known about landscape-level distributions of these species or landscape-level aspects of their life-histories. I used a watershed-wide sample and logistic regression to develop models and maps of probability of occurrence throughout the Blue River watershed stream network using widely available and/or easily derivable explanatory variables in pixelized GIS format. I also developed a multi-scale model-building process to discern the strength of association of site-level variables in the presence of larger-scale, context variables. Finally, I investigated size distributions of stream amphibians within the stream network. *Rhyacotriton cascadae* larvae were detected only in streams with basins <=141 ha, and were more frequently found in steeper regions of the watershed. *Ascaphus truei* life stages differed in their occurrence within the stream network, larvae being found most frequently in moderate-sized streams below headwaters where metamorphosed individuals were more frequent. Average sizes of *Dicamptodon tenebrosus* larvae were larger in larger streams. Patterns observed in this study suggest that reach-level studies could benefit by accounting for or controlling variation associated with large-scale environmental gradients. Similarly, terrestrial studies

should consider the possibility of similar landscape-level patterns of terrestrial stages of stream-breeding amphibians. Lastly, patterns observed in this study provide a basis for development of hypotheses of landscape-level life-histories.

Johnson, David H.,[1] Monica M. Hoover[2], Eva L. Greda[1], and C. Jeff Cederholm[3]. **Relationship Between Pacific Salmon and 605 Species of Birds, Mammals, Reptiles, and Amphibians in Oregon and Washington.** [1]Washington Dept. of Fish and Wildlife, Olympia, WA, [2] Olympia, WA, [3]Washington Dept. of Natural Resources, Olympia, WA.

We used a scientific panel process and published literature to characterize the relationship between seven species of Pacific salmon (Oncorhynchus spp.) (viewed collectively) and 605 mammals, birds, reptiles, and amphibians currently or historically common to Oregon and Washington. A relationship was found between salmon and 137 species of wildlife, the relationship was "unknown" for 60 species, and a determination of "no relationship" was made for 408 species. Where a relationship existed, we identified both the type of relationship and the stage(s) of the salmon life cycle to which it applied. Of the 137 species with a relationship to salmon, 9 species were categorized as having a Strong, Consistent relationship; 58 as Recurrent; 25 as Indirect; and 64 as Rare. This tally totals more than 137 because 19 species had more than one type of relationship with salmon. The five salmon life stages, and the number of wildlife species associated with each (in parenthesis) were: Incubation (23); Freshwater Rearing (49); Saltwater (63); Spawning (16), and Carcasses (82); this tally of wildlife species totals more than 158 because 73 species are associated with salmon at several life stages. This "salmon species-ecology web" analysis identified the collective set of bird, mammal, reptile, and amphibian species which (a) depend on salmon, (b) would benefit from salmon and salmon habitat conservation, and (c) highlight key salmon-centric relationships which are contributing directly to overall ecosystem biodiversity, productivity, and sustainability. The primary information collected in this study came from 68 scientists and managers in the PNW, to whom we are indebted, and over 300 published and unpublished reports.

Johnson, David H.[1], and Thomas A. O'Neil[2]. **Wildlife Habitat Relationships in Oregon and Washington – An Update.** [1]WA Dept. of Fish and Wildlife, Olympia WA, and [2]NW Habitat Institute, Corvallis, OR.

The "Species Habitat Project", as it is commonly referred to, is very nearcompletion. The project has been developed with the support of 33 ProjectPartners, involved over 600 people, and has taken 4 years to complete. The purpose of the effort was to build a common understanding about the terrestrial, freshwater, and marine habitats of Oregon and Washington and the wildlife that depend upon them. This significant compilation, synthesizes and greatly expands upon earlier works, and the 27 chapters (written by 88 authors) offer detailed insights into the 32 wildlife-habitat types and relationships with 605 wildlife species; profiles of wildlife communities; reviews of genetics, introduced, and extirpated species; modeling; and describe what the latest thinking and approaches are regarding the management of wildlife and wildlife habitats. The CD-Rom contains information on 8 matrices and links the 605 wildlife species with their respective wildlife-habitat types, structural conditions, habitat elements, life histories, key ecological functions, management activities, salmon-wildlife relationships, and literature citations. Also, the project offers the first statewide wildlife habitat-type maps of Oregon and Washington, and offers definitions of more than 250 terms that are used to describe wildlife and habitat relationships. The presentation will review components of the project,as well as timing of delivery of the final products.

Jones, Lawrence L. C., and Martin G. Raphael. **Diel patterns of surface activity and microhabitat use by stream-dwelling amphibians in the Olympic Peninsula.** USDA Forest Service, PNW Research Station, Olympia, WA.

We studied diel activity and microhabitat use by stream-dwelling amphibians on the Olympic Peninsula, Washington. Using a 200,000 candlepower spotlamp to conduct visual surveys during the day and night, we obtained 4,475 detections of 10 vertebrate species at 13 streams. Three species comprised the common amphibian fauna: *Dicamptodon copei*, *Rhyacotriton olympicus*, and *Ascaphus truei*. Larval *A. truei* and *R. olympicus* were primarily diurnal, whereas *D. copei* and adult *A. truei* were largely nocturnal. Adult *R. olympicus* were surface-active both day and night. *Ascaphus* larvae used large rocky substrates and were active in both slow and fast waters. *Dicamptodon* were primarily seen in pools; large larviform adults were

usually under large boulders, but smaller individuals used a variety of substrates. *Rhyacotriton* showed the most diverse patterns of microhabitat use. During dry summer months, adults were most active when air temperatures near the stream were between 10 and 17° C. During the day, they were most abundant in the splash zone; at night they tended to be in pools, often near the edge. During the fall, *R. olympicus* were often found on the streambank beyond the splash zone. Larval *Rhyacotriton* were usually surface-active on silt in shallow pools, whereas adults were associated with larger substrates. Although these differential patterns of habitat use by *Rhyacotriton* were partially driven by environmental factors (adults clearly demonstrated behavioral hydro- and thermoregulation during the summer), we suspect they may have been exhibiting foraging strategies in response to prey availability.

Jones, Lawrence L. L. L. C., Janet L. L. Jones, Uncle Nardly, J. Jay, Barnabas Zokvinov, and Iolanthe. **Endemic Fauna of the Owyheean Islands off the Coast of Idaho: Speciation and Evolution from Millennial Stimulation**. Instituto de Bunko Historico Naturale, 666 Snorkybork Lane, Wallawallawa University for the Conceptually Challenged. Website: www.www.www.www.com.

When we voyaged to the Owyheean Islands for the 30,007th time in 6 years, we were fortunate to witness evolution in action. As we pulled up to the shores of the "big island" (Spudnick) on December 31, 1999, at 11:59:59 PM, strange things began to happen. First there was a total eclipse of the sun; but since it was on the other side of the world, it didn't concern us much. Then a comet, an asteroid, and a UFO darkened the pitch-black night sky. Suddenly there was a shift in hormonal activity of the native wildlife and the endemic fauna began to get frisky. We witnessed a phenomenon now known as global trans-species reproductive promiscuity. The pheromones were so thick that night the air was sticky to the touch. We documented phishes hybridizing with boids and mamms with amfi-beans. We even saw the first conception of a vertebrate-rock hybrid (which may explain the origin of the Primordial Encrusting Mammal. The horrific Proteropteryx was momentarily soothed into amorous behavior and successfully mated with the Not-So-Appealing-Faced Bat (needless to say the offspring were disgusting to look and had a really bad attitude). Now the Islands boast twice as many endemics, many of which represent new vertebrate classes (including some Owyheean-crew member hybrids). Interestingly, some of the inhabitants were unaffected. We hypothesize that they believe the true millennium was still a year away. *(Poster)*

Jorgensen, Kelley. K. **Northwest Forest Plan Survey and Manage Issues and Transportation Projects: A case study from SR12 White Pass in the Gifford Pinchot National Forest.** Washington State Dept. of Transportation, Olympia, WA.

In 1998 WSDOT began planning slope stabilization projects along State Route 12 between Packwood and White Pass in the Gifford Pinchot National Forest. The projects are designed to improve safety conditions resulting from eroding slopes and failing rock outcrops. Because some of these projects involve ground-disturbing activities in forested habitat, we conducted surveys as required by the Northwest Forest Plan. The project area consists of a south-facing, mature conifer forest, below a large talus slope, at approximately 915 m elevation. Terrestrial mollusk and salamander surveys were conducted in spring and fall of 1999. Amphibians detected in the project area include *Plethodon larselli*, *Ensatina eschscholtzii*, *Hyla regilla*, and *Rana cascadae*. Mollusks detected at the site include *Haplotrema vancouverense*, *Ancotrema sportella*, *Vespericola columbiana*, *Monadenia fidelis*, *Ariolimax columbianus*, *Hemphillia dromedarius*, *and Prophysaon vanattae*. The only Survey and Manage species detected was *P. larselli*. Survey and Management recommendations currently are unavailable, and are likely to emphasize the avoidance of impacts to occupied habitat. Management recommendations should also provide guidance for non-forest practice activities with unavoidable impacts, such as transportation projects subject to the Northwest Forest Plan. The current project has been designed to avoid and minimize environmental impacts to the extent practicable. Compensatory and alternative mitigation strategies may be the best management option and can optimize meaningful, ecological benefits to the species and their habitats. Mitigation opportunities for such projects include habitat improvements, such as augmentation of on-site large, woody debris, and the funding of research or additional surveys.

Kelsey , Kathryn A., and Ashley Steel. **The TRUTH About Science.** Seattle, WA.

The TRUTH About Science is a middle school science curriculum that guides students through the process of scientific research. It was developed and piloted in the Seattle School District in the academic year 1998 1999. Initial support was provided by matching funds from the Discuren Foundation and the National Research Center for Statistics and the Environment (NRCSE) at the University of Washington. The curriculum covers all aspects of the scientific process: asking testable research questions, defining hypotheses, designing a research project, collecting data in the field, organizing and summarizing data, analyzing data with simple statistics, and presenting research results as both posters and oral presentations. The 40 lessons in the curriculum teach students specific science-oriented skills such as making quantitative observations, writing a research report, organizing data, calculating a t-statistic, and speaking in public. The lessons guide students through an independent long-term research project (LTRP) in which students ask and answer their own research questions. Through the LTRP, students have a unique opportunity to be scientists, to uncover new information, and, to present it to their peers. The goals of The TRUTH About Science project are not only to push students toward developing scientific skills but also to expose them to the creative, fun, and challenging aspects of scientific research. *(Poster)*

Kinan, Irene.T.[1], and Cousins, K.[2]. **Abundance of Plastic Debris and Ingestion by Albatross on Kure Atoll, Northwestern Hawaiian Islands.** [1]Washington Dept. of Fish and Wildlife, Olympia, WA, [2]National Marine Fisheries Service, Honolulu, HI. *(Poster)*

A study to investigate the abundance of disposable lighters and chemical glowsticks with the incidence of ingestion by albatross was conducted at Kure Atoll, Northwestern Hawaiian Islands. A total of 837 disposable lighters and 200 chemical glowsticks were collected opportunistically between 25 May and 23 July 1999. To examine occurrence of plastics ingested by Black-footed albatross (*Diomedea nigripes*) and Laysan albatross (*D. immutabilis*), 43 samples were collected including: 17 Laysan boluses (regurgitations), contents of seven Laysan nestcups, stomach contents from two Laysan carcasses, and 17 Black-footed boluses. Plastics comprised 57% of Laysan boluses (n=17) averaging 28 grams (±15.4) of plastic per bolus. Mean weight of plastics removed from carcasses (n=7) in nestcups equaled 152 grams (±73). Of Laysan chicks necropsied, one contained 475 grams of plastic and the second contained 90 grams. Of total Laysan samples (n=26) six included disposable lighters (23%), other items included: squid beaks, plastic pieces and chips of various sizes; resin pellets, caps, tubing, bags and toys; toothbrush; fishing floats; Styrofoam; pumice stones; walnuts and neoprene material. The average Black-footed bolus (n=17) weighed 78 grams (±36.5), consisting mainly of squid beaks and monofilament nylon line. A correlation may exist between availability of plastics in a region and seabirds in the community that ingest plastic. To quantify the abundance and turn over rates of plastics available to sea birds at Kure we recommend continued collection of disposable lighters and glowsticks. In terms of conservation, to investigate negative human and commercial fishery impacts on reproductive success rates of albatross, future bolus collections and necropsies of deceased chicks is necessary.

Koehler, Gary. M. **Black bear survival rates and mortality causes in Washington, 1994-1999: a preliminary analysis.** Washington Dept. of Fish and Wildlife, Olympia, WA.

One-hundred and fifty-three black bears (*Ursus americanus*) were captured and marked with radio-telemetry transmitters and their activities monitored from 1994-1999 in Okanogan, King and Gray Harbor counties. The objectives were to determine cause of mortalities and compare survival rates between gender, age-classes, years, study areas, degrees of road access, and pre- and post-initiative periods that banned the use of bait and hounds to hunt bears.

Krupka, Jeffrey M. **Partners in Amphibian and Reptile Conservation (PARC) – the Who, What, When, Where, and How.** U.S. Fish and Wildlife Service, Wenatchee, WA.

Partners in Amphibian and Reptile Conservation (PARC) is a recently formed organization assembled to address the conservation of amphibians and reptiles. PARC seeks not to duplicate the efforts of existing amphibian and reptile conservation, but rather strives to coordinate these actions and provide technical assistance. Priority actions include to survey what information is currently available, describe conservation needs and data gaps, develop standards for data collection and analysis, compile a comprehensive database of

literature, and raise the public's awareness of amphibian and reptile conservation issues. PARC has established a national and regional organizational structure and fields habitat management, research, monitoring, policy/regulations/trade, education, and international working groups. PARC is about partners--including state, federal, local governments; industry; non-government organizations; and private land owners--willing to advance the conservation cause for amphibians and reptiles.

Lambourn, D.M.[1], Jeffries, S.J[1]., Huber, H.R.[2], Gearin, P.J.[2], Hughes, K.M.[2], Garner, M.M.[3], Ewalt, D.R.[4], Rhyan, J.C[5]. **Evidence of *Brucella* Sp. Infection in Pacific Harbor Seals (*Phoca Vitulina Richardsii*) and California Sea Lions (*Zalophus Californianus*) from Washington.** [1]Washington Dept. of Fish and Wildlife, Olympia, WA, [2]National Marine Mammal Laboratory, Seattle, WA, [3]Northwest ZooPath, Snohomish, WA, [4]National Veterinary Services Laboratories, Ames, IA, [5]National Wildlife Research, Fort Collins, CO. *(Poster)*

Blood samples were collected from Pacific harbor seals and California sea lions during capture and marking operations in Washington, from 1994 to 1999. Positive or suspect titres to *Brucella abortus* antigen occurred in 81 of 713 harbor seals (11%) and ten of 156 California seal lions (6%) captured. Since 1995, blood samples and tissues were also collected from stranded marine mammals and tested for *Brucella*. A *Brucella* sp. was cultured and isolated from 7 harbor seals. The *Brucella* sp. has been isolated from all lymph nodes and most body tissue and fluids (14 of 19). The *Brucella* sp. isolates from Washington seals appear to be biochemically similar to a strain isolated from a seal in the United Kingdom although genetically distinct. Most affected seals were emaciated and had severe verminous pneumonia with intralesional *Parafilaroides* sp. lungworms. Some adult worms had large numbers of minute bacterial coccobacillus along the inner membrane of the uterus and within gut lumen. Immunohistochemistry using a *Brucella abortus* antibodies revealed large quantities of an antigen within *Parafilaroides* sp., within cytoplasm of leukocytes in the surrounding pulmonary parenchyma and affect lymph nodes. WDFW has begun screening harbor porpoise, sea otter, Steller sea lion, northern elephant seals and northern fur seal for evidence of *Brucella*. Harbor porpoise (five of 16) and northern fur seals (two of 5) had suspect or positive titres to *Brucella* antigen. Little is known of this new marine *Brucella* species. Caution should be taken when handling marine mammals due to potential risk of transmission.

Linders, Mary J.[1], Stephen D. West,[1] and Matthew Vander Haegen.[2] **Seasonal movement patterns of the western gray squirrel, *Sciurus griseus*, in Washington.** [1]Univ. of Washington, Seattle, WA; [2]Washington Dept. of Fish and Wildlife, Olympia, WA.

Western gray squirrel populations in both Washington and Oregon have been declining since the 1950's. Despite this knowledge and a corresponding lack of natural history data, little attention has been directed toward this State-threatened small mammal. With ongoing reductions of its Washington habitat, accurate measures of home range and habitat parameters are critical for its management. Using radio-telemetry we have uncovered important differences in sexual and seasonal patterns of habitat use by documenting the movements of 24 western gray squirrels in Klickitat County, Washington. Home ranges were significantly larger than previous studies and varied with season.

Lohman, Kirk. **Temporal and spatial variability in the abundance of tailed frog tadpoles (*Ascaphus truei*) in a northern Idaho watershed.** Dept. of Fish & Wildlife, Univ. of Idaho, Moscow, ID.

Dramatic annual fluctuations in abundance are common among many amphibian populations. Little is known about variability in the abundance of tailed frogs (*Ascaphus truei*), a stream amphibian characteristic of small streams in forested watersheds in the PNW. I surveyed streams within the Mica Creek Experimental Watershed in northern Idaho to estimate temporal and spatial variability in the abundance of tailed frog tadpoles. Six streams were sampled in July over 3 successive years (1997-1999). Mean tadpole density was similar within the watershed in 1997 and 1998, averaging 1.96 and 2.32 individuals/m^2, but was substantially greater in 1999, averaging 8.28 individuals/m^2. Densities at all 6 sites were 3-10 fold greater in 1999 than in either 1997 or 1998. Among sites, densities were 0.36-4.08 individuals/m^2 in 1997, 0.38-4.07 individuals/m^2 in 1998, and 3.27-19.55 individuals/m^2 in 1999. Most of the increase in abundance at all sites in 1999 was attributable to a strong first-year age class and low apparent mortality among older age classes. Increases in tadpole densities in the Mica Creek watershed may be partially explained by the absence of extremely high flow events during 1997-1999.

London, Josh M.[1], Wilson, Monique L.[2] and Jeffries, Steve J.[2] **Foraging Ecology of Harbor Seals in Hood Canal and the Potential Impacts on Threatened Salmonid Stocks.** [1]Washington Cooperative Fish & Wildlife Research Unit, UW School of Fisheries, [2]Washington Department of Fish and Wildlife. *(Poster)*

In the fall of 1998 and 1999, the Washington Department of Fish and Wildlife (WDFW) began efforts to evaluate the potentially negative effects of predation by pinnipeds on the recovery of depressed salmon runs in Hood Canal. Hood Canal became the focus of these efforts because of the isolated nature of the system and the presence of abundant harbor seal (*Phoca vitulina*) populations along with salmonid stocks of concern. Surface observations were used to document harbor seal predation on returning adult salmon. Scat samples were collected to determine food habits and provide additional insights into predation salmonids. Field studies were located at the mouths of the Quilcene, Dosewallips, Duckabush, and Hamma Hamma river systems in 1998 and 1999. Field observations provided 817 hours of observation for surface predation events between September 5 and November 20, 1998, and 1200 hours of observation between August 15 and November 15, 1999. Predation estimates from 1998 show that harbor seal predation accounted for anywhere from 2-12% of the returning summer chum at the four river systems. Scats collected in 1998 (n=601) showed that Pacific hake were the most common prey item at 84.8% frequency of occurrence followed by herring (43.7%) and salmon (25.4%). The combination of surface observations and scat analysis for prey identification provide quantitative information on the predation rates of seals on salmonids. This poster will also provide preliminary data from 1999 and discuss the implications of night predation.

MacCracken, James G. **The Washington landowner landscape plan pilot program from the landowners perspective.** Timber Dept., Longview Fibre Company, Longview, WA.

The 7 landowners that volunteered for the program were surveyed as to their expectations, successes, and problems. Regulatory certainty and access to resources that had been constrained due to regulation were the 2 benefits most often cited by landowners. Successes were few with only 2-3 landowners submitting plans and none approved at this time. Lack of flexibility, personnel changes, inadequate funding, unresolved policy issues, and an unrealistic time line were the primary problems. Whether the program will continue is unknown.

MacCracken, James G. **Wildlife response to salmon habitat enhancement on the Bear River, southwest Washington**. Timber Dept., Longview Fibre Company, Longview, WA.

In 1997, large wood was added to13 sites in the Bear River of southwest Washington and 4 kilometers of riparian red alder (*Alnus rubra*) forest were thinned and planted to conifer. Small mammal and amphibian abundance was similar (P = 0.45) between thinned and control red alder stands from 1997-99. Beaver (*Castor canadensis*) activity increased and dam construction was often associated with an introduced large wood structure.

Mahoney, Meredith J., Vance T. Vredenburg, Joyce Gross, and David B. Wake. **Amphibiaweb: An information system for amphibian conservation biology.** Museum of Vertebrate Zoology, Dept. of Integrative Biology, and Dept. of Computer Science (JG), Univ. of California, Berkeley, CA. *(Poster)*

We have the ambitious goal of establishing a "home page" for every amphibian species in the world. AmphibiaWeb is an online system enabling anyone with a Web browser to quickly search and retrieve information relating to amphibian biology and conservation. This site was inspired by the global declines of amphibians, the study of which has been hindered by the lack of multidisciplinary studies and a lack of coordination in monitoring, in field studies, and in lab studies. AmphibiaWeb currently consists of over 100 species accounts on species from around the world; new accounts are posted to the site regularly. Accounts contain species descriptions, life history information, conservation status, and literature references. Many species accounts are linked to photos and range maps. Species accounts are also linked to taxonomic information (Amphibian Species of the World, American Museum of Natural History), as well as the Museum of Vertebrate Zoology (UC Berkeley) allowing on-line access to specimen data. The ultimate success of AmphibiaWeb depends on steady addition of species accounts, supporting data such as maps and photographs, and regular revision as new information becomes available. We appeal to volunteers who are willing to prepare

accounts, or provide photos and data. We hope AmphibiaWeb will encourage a shared vision for the study of global amphibian declines and the conservation of remaining amphibians. AmphibiaWeb may be found at http://www.amphibiaweb.org.

Matsuda, Brent M., and John S. Richardson. **Assessing the effects of clear-cut timber harvest on the movement patterns of tailed frogs (*Ascaphus truei*) in southwestern British Columbia.** Dept. of Forest Sciences, Univ. of British Columbia, Vancouver, British Columbia, Canada

Despite many studies of tailed frog larvae (*Ascaphus truei*) in British Columbia (BC), there has been little study of juvenile and adult habitat use, patterns of movement, and dispersal. The primary objective of this research was to determine if clear-cut timber harvesting has any effect on the movement patterns of tailed frogs by comparing movement rates, abundance, distance and direction in clear-cuts to that occurring in relatively undisturbed forests (mature second growth stands). Grids of pitfall traps and drift fences were established in three mature stands (>81 years) and three clear-cut habitats (<5 years, no buffers) in the Chilliwack Valley of southwestern BC. Frog abundance was similar in both habitats, with pre-reproductive juveniles (immatures) comprising 80% of captures in clear-cuts and 50% in mature stands. ANCOVA (p=0.05) indicated that significantly more adults were caught in mature stands than clear-cut sites, with little difference between other age classes. Although immatures were not significantly affected by habitat type, site variation within the same habitat was significant for movement direction and capture distance from streamside. Overall, more frogs were caught moving parallel to the stream than perpendicular in both habitats, although this difference was not significant. Less than 10% of frogs were recaptured, suggesting that frogs caught within the study sites were predominantly new individuals moving through the area. Goodness-of-Fit X^2 analysis indicated that recaptures were significantly greater in mature stands, with the Fisher-Exact test (a=0.05) suggesting that a significantly greater ratio of recaptures in mature stands originated from other locations, whereas in clear-cuts, recaptures predominantly consisted of frogs which returned to traps immediately upon release. These findings suggest that immatures are more active and may travel greater distances in clear-cuts, which may have long-term implications on population maintenance if disperser survivorship varies significantly from that occurring in relatively undisturbed (mature) habitats.

Moon, Brad R., William Kemper, Kevin E. Conley, Lynn Hartzler, and James H. Hicks. **How rattlesnakes rattle.** Univ. of Washington, Seattle and Univ. of California, Irvine.

Rattling in rattlesnakes is one of the fastest vertebrate movements. Rattling twitch frequency ranges from 22-100 Hz over temperatures of 5-35 degrees C. The highly specialized shaker muscles have high concentrations of capillaries, mitochondria, sarcoplasmic reticulum, and glycogen. These features support high rates of both oxidative and glycolytic metabolism; high blood flow rates prevent fatigue by removing lactic acid. The shaker muscles have few contractile fibers, and therefore low forces. Rattling force increases with frequency, but twitch duration decreases. This tradeoff indicates a constant number of cross-bridges per twitch, which may explain the constant energy cost per twitch.

Musser, John L., and Tom McCall. **Status of Washington's pygmy rabbit - recovery of an endangered species - work in progress.** Washington Dept. of Fish and Wildlife, Wenatchee, WA.

Prior to 1977 pygmy rabbit, *Brachylagus idahoensis*, was believed extirpated from Washington. Since 1977, several small, isolated populations have been discovered. Since 1991, the largest population, found at Sagebrush Flat in Central Washington, has declined significantly. Pygmy rabbit is classified as endangered in Washington. Pygmy rabbit range in Washington is disjunct from connected populations in the West. Washington Dept. of Fish and Wildlife is working to recover the species through acquisition and management of habitat, predator control, genetic evaluation and augmentation.

Nyland, Philip D., and G. M. Koehler. **Preliminary assessment of black bear habitat use of intensively managed forest landscapes in western Washington.** Washington Dept. of Fish and Wildife, Olympia, WA.

We used forest inventory data from five timber managers to assess black bear (*Ursus americanus*) use of intensively managed forests in the Olympic peninsula foothills and west slope of the Cascades. Geographical information systems were employed to extract forest stand composition, stand age, average diameter, average

stems per acre, average basal area, and elevation at 2043 black bear locations and 3948 random locations. Contingency table analysis was used to test seasonal use versus availability of nine stand types at three elevation ranges. Preliminary results of seasonal resource selection between males and females are presented.

Ogden, Cay. **The history behind the Northwest Forest Plan Survey and Manage provisions.** Regional Wildlife Ecologist, U.S. Forest Service, Region 6, Portland, OR.

For years federal land management agencies have used sensitive species programs and management indicator species concepts to steer land management decisions, with a goal of conserving native biodiversity. Though these measures were in place in the PNW, conservation work in the early 1990's identified a number of older forest-associated species for which there were questions about their continued survival. In this presentation I will recount the 10-year history of this conservation work from the Recovery Plan for the Northern Spotted Owl through the decision and implementation of the Northwest Forest Plan.

O'Halloran, Kathy. **Olympic National Forest's experience and observations of implementing the Survey and Manage program.**

No Abstract Submitted.

Ollivier, Lisa M., and Hartwell H. Welsh, Jr. **A Hierarchical Analysis of The Habitat Correlates of The Siskiyou Mountains Salamander (*Plethodon Stormi*): as North Meets South**. USDA Forest Service, Pacific Southwest Research Station, Arcata CA.

We employed a stratified sampling design to analyze the habitat correlates of the Siskiyou Mountains salamander throughout its known range. This species is a rare endemic to the PNW, whose range is split evenly between extreme southwestern Oregon and extreme northwestern California. We employed a bioregional approach by dividing the data set along the Siskiyou crest. This division reflects the differences in climate and vegetation composition found in the two portions of the range. Variables representing 3 spatial scales (landscape, macrohabitat and microhabitat) and 14 ecologically meaningful groupings of variables were examined for association with the presence and relative abundance of Siskiyou Mountains salamanders. These multivariate analyses revealed relationships with the stand structure, and surface and subsurface conditions of the sites sampled. Distinct differences emerged between the northern and southern halves of the species range in habitat correlates that influenced salamander presence and relative abundance.

Olson, Deanna H.[1], and Theodore M. Davis[2]. **Terrestrial salamander sampling: development of a monitoring program.** [1]PNW Research Station, USDA Forest Service, Corvallis, OR. [2]Dept. of Biology, Univ. of Victoria, Victoria, B.C.

The October 1999 workshop "Terrestrial Salamander Monitoring" in Ontario, Canada, resulted in a synthesis of sampling methods and the design of a regional monitoring program. The "toolbox" of survey methods for terrestrial salamanders includes area-constrained searches (transects, grids, plots), time-constrained searches, night searches (timed and/or area-constrained), cover objects (boards, bricks), and drift fences and pitfall traps. Biases, logistical constraints, advantages and disadvantages of each approach were evaluated. Technique standardization, disturbance to animals, and habitat modification were key concerns for several population monitoring techniques. A two-phase program was designed primarily for redback salamanders in the province of Ontario: 1) distribution assessment using timed transect searches (2-m x 1 km along established bird plots, 2 hr search maximum with moving rules, turn objects >10cm dia., stop when 5 salamanders detected, 1 hr additional opportunistic search if no captures, 10 C temperature minimum, Spring sampling with timing based on activity at reference sites); and 2) demographic monitoring of selected populations using cover boards along transects (1 km transect along established bird plots, 100 boards placed every 10 m, Spring sampling with timing based on activity at reference sites, weekly sampling, board placement in Fall and first sampling next Spring, board replacement every 3 yrs with 1/3 of sites replaced annually). Protocols used in the Ontario program will be important to consider as additional large-scale terrestrial salamander monitoring programs become established. Methodological standardization is critical for pattern evaluation and trend assessment.

Olson, Deanna H., George W. Weaver, Loretta L. Ellenburg, Bruce Hansen, and Rebecca Thompson. **Stream vertebrates in managed headwater streams: habitat associations of assemblages and species .** PNW Research Station, USDA Forest Service, Corvallis, OR.

A greater understanding of the ecology of headwater stream vertebrates in managed forest stands is needed for the refinement of forestry practices that manage for multiple resources, including species, habitats and socio-economic values. Pretreatment sampling for our Riparian Buffer Study in western Oregon has revealed distinct amphibian and fish assemblages corresponding to instream habitat gradients in headwaters. Habitat and faunal data were collected across 13 study basins and > 140 headwater stream reaches; over 4,000 animals of 15 taxa have been sampled. Canonical correlations were calculated separately for instream species-assemblages, instream and bank fauna, and bank amphibians. Results identifed several distinct species-assemblages, each with ranked habitat correlates. Assemblage patterns were more related to hydrological, topographic, and geomorphic habitat attributes (e.g., channel flow type and size, gradient) than fine scale microhabitat features (e.g., downed wood, substrate size). Generalized linear models (Poisson and logistic regression) of individual species-habitat relations were generated for 7 taxa (trout spp., cottid spp., *D. tenebrosus*, *Rhyacotriton variegatus*, *R. cascadae*, *P. dunni*, *A. truei*, and *Taricha granulosa*). Results correspond to assemblage-associations. Our study shows the relatively restricted use of the uppermost nonfish-bearing stream channel by a unique amphibian assemblage dominated by torrent salamander species, currently a species of concern in the region. Our Riparian Buffer Study treatments are designed to advance the development of management approaches that have a high likelihood of persistence of such sensitive species within managed watersheds.

Ovaska, Kristiina[1], and Theodore Davis[2]. **Marking salamanders for individual recognition: toe-clipping and fluorescent-elastomer tagging.** [1]Dept. of Forest Sciences, Univ. of British Columbia, Vancouver, British Columbia, and Biolinx Environmental Research Ltd., Victoria, British Columbia, [2]Dept. of Biology, Univ. of Victoria, British Columbia, Canada.

Marking amphibians for individual recognition is required for a variety of monitoring and research purposes, but possible adverse effects of different techniques on the animals have received little study. We examined the efficacy of toe-clipping and fluorescent-elastomer tagging for individual recognition of the Western Red-backed Salamander, *Plethodon vehiculum*, in the laboratory and in the field on Vancouver Island, British Columbia. In the laboratory, no confirmed mortality of marked or unmarked salamanders took place over a 64-week period. All but one of 17 fluorescent-marked individuals retained their marks for the duration of the study. The number of misidentified toe-clips increased steadily after 35 weeks from marking, whereas misidentifications of fluorescent-marked salamanders remained low. In the field, from September 1997 to May 1999, growth rates and movements of salamanders were similar for both marking methods, but we recaptured more fluorescent-marked than toe-clipped individuals. In a second field experiment from 27 April to 31 May 1999, movements of fluorescent-marked, toe-clipped, and unmarked control salamanders (identified through pattern mapping from photographs) were also similar. However, toe-clipped salamanders (n = 22) gained less weight in relation to their initial body size than did fluorescent-marked (n = 19) and control salamanders (n = 17). These data suggest that toe-clipping might affect the ability of individuals to take full advantage of optimal foraging conditions (warm and wet) that prevail in May, which in turn might result in a decrease in stored energy reserves required for survival over adverse, dry periods in summer.

Pfeifer, Bob. **Potential effects of trout stocking on invertebrates and salamanders in Washington high lakes**. Parametrix, Inc. Kirkland, WA.

Most lakes in Washington above 2500 ft msl were fishless after the Pleistocene glaciation. Trout were introduced into many by loggers, miners, cattle and sheep herders, sport fishing groups, the US Forest Service, and the Washington Dept. of Game. Focused scientific habitat surveys and development of lake by lake management plans began in earnest in Washington in the early 1970s. Currently, 40% are periodically stocked, 26% are fishless, and 43% have some level of trout natural reproduction in a sub-sample of 532 west-central Cascades lakes. A recent literature review by the Washington Dept. of Fish and Wildlife (WDFW) found long-toed salamander potentially at risk in some lakes, as well as large, conspicuous invertebrates. Risks to these species is almost always associated with excessive trout density, which in turn is most commonly due to natural reproduction by eastern brook and westslope cutthroat trout. Excessive abundance of

trout can reduce larger invertebrate forms to non-detectable levels, or extirpation. WDFW stocking densities are generally well below levels that lead to species reductions to non-detectable levels. Both salamanders and macroinvertebrates are documented to thrive in sympatry with trout in many lakes that have been stocked at low densities for decades. To date, no salamander or invertebrate species native to Washington high lakes have been shown to be reduced or extirpated in any significant portion of their natural range, or submitted for protection under the ESA.

Rand, G., M. Hall, K. Engel, and R. Fairbanks. **Sampling for Survey and Manage Species in the Cascade Mountains of Washington**. All authors at Foster Wheeler Environmental Corporation, Bellevue, WA. *(Poster)*

Between 1997 and 1999, amphibian and mollusk surveys were conducted at selected sites throughout the Cascades in support of several projects. The first project spanned an area of more than 100,000 acres to support the evaluation of a land exchange between the U.S. Forest Service and Plum Creek Timber Company, LLP in Washington State. To survey for these species over such a large and diverse landscape, a subsampling methodology was developed that focused on habitat with a high probability of supporting populations of target Survey and Manage species. Survey results included the detection and documentation of 3 new populations of the Larch Mountain salamander (*Plethodon larselli*), and 5 new populations of mollusks. Survey results were a key factor in evaluating the anticipated effects of the proposed exchange on these species. The results of surveys for two other site-specific projects in other areas of the Cascades will also be summarized.

Rice, Clifford G., and D. Ware. **Pheasant brood and crow surveys: what good are they.** Washington Dept. of Fish and Wildlife, Olympia, WA.

The Washington Dept. of Fish and Wildlife conducts surveys of pheasant brood surveys and crowing counts of cocks along fixed routes annually. We evaluated the utility of these surveys for assessing trends in pheasant population levels and for predicting harvest during the following season for county, basin, and statewide scales. Statistical power analysis indicated that crow counts were superior to brood counts for detecting changes between years. For example, we found that a 40% decline between 2 years would likely be detected (power=0.9) with 12 routes, a 60% decline with 4 routes. We analyzed survey indices and harvest (birds/day or total harvest) with linear regression and ordinal logistic regression (to predict high, medium, and low harvest). Generally speaking, total harvest was predicted more precisely than harvest/day. Brood counts were a better predictor of total harvest than were crow counts. Nevertheless, predicting harvest at the 90% confidence level was realistic only at the statewide level. Ordinal logistic regression provided another perspective on this prediction process, but did not improve the level of resolution possible for predicting harvest. In interpreting these findings, it should be considered that our harvest estimates themselves have considerable statistical error. Actual (but unknown) harvest may be predicted more precisely than our estimated harvest. Also, closer relationships existed in several individual counties which may indicate our surveys are better predictors in those locations.

Rochelle, James A. **Forest Fragmentation: Wildlife and Management Implications**. Rochelle Environmental Forestry Consulting. Olympia, WA.

This presentation summarizes findings from a scientific conference held in November, 1998 which addressed fragmentation in relation to forest management and the consequences for wildife populations in the forests of the western United States and Canada. Fragmentation is defined as the process of reducing size and connectivity of stands composing a forest. It differentiates habitat fragmentation from habitat loss, such as that which results from converting forest land to agricultural and urban uses. Evidence of negative effects on vertebrate biodiversity from changes in the configuration of forest habitat is limited. Conference findings indicate that total amount of habitat is of greater significance to vertebrate survival and productivity than how it is configured, and suggest that prevention of habitat loss should be the higher conservation priority.

Rundio, David E., and Deanna H. Olson. **Palatability of southern torrent salamander larvae to Pacific giant salamander larvae**. PNW Research Station, USDA Forest Service, Corvallis OR.

The structure and distribution of amphibian assemblages can be strongly influenced by both predation and antipredator defenses. Unpalatability is a common defense among amphibians, and several studies have shown that palatable prey have disjunct distributions relative to predators. We tested the palatability of southern torrent salamander larvae (*Rhyacotriton variegatus*) to Pacific giant salamander larvae *(Dicamptodon tenebrosus*) in paired trials. These two species appear to be segregated longitudinally along streams, suggesting *Rhyacotriton* palatability and a strong predator-prey interaction. Unexpectedly, tests showed *Rhyacotriton* was relatively unpalatable to *Dicamptodon*. *Rhyacotriton* survived in more trials (76%, N = 39) than control prey (*Plethodon* spp., 3%). The number of attacks preceding consumption or rejection was greater for *Rhyacotriton* than for *Plethodon*. All but three *Plethodon* were consumed during the first attack. In contrast, 5 of 9 consumed *Rhyacotriton* were rejected after the first attack. Twenty-eight percent of surviving *Rhyacotriton* were attacked and rejected two or more times (to a high of 7), and only one showed injuries (a small laceration to its back). We therefore expect that our results underestimate the effectiveness of unpalatability on the survival of *Rhyacotriton* in nature, where repeat attacks should be less likely. Our results suggest that the relationship between palatability and distribution may be more complex than previously indicated, although the interpretation of our results is limited by a poor understanding of the mechanisms regulating stream amphibian assemblages in the PNW.

Rundio, David E.[1], and Charles P. Hawkins[2]. **Effects of tailed frog tadpole density on tadpole growth, invertebrate abundance, and algal abundance**. [1]PNW Research Station, USDA Forest Service, Corvallis OR; [2]Dept. of Fisheries and Wildlife, Utah State Univ., Logan UT.

Tailed frog (*Ascaphus truei*) larvae can be the dominant herbivore in high-gradient streams in the PNW. Previous studies indicated that the abundance of periphyton and small invertebrates often is inversely related to tadpole abundance. We do not know, however, what impact tadpole density has on tadpole growth or on the abundance of larger stream invertebrates. In this study we experimentally tested the hypotheses that increasing tadpole density would (1) reduce periphyton abundance, (2) reduce tadpole growth, (3) increase tadpole feeding activity and emigration, and (4) reduce the abundance of other stream herbivores. We manipulated tadpole density in two *in situ* experiments in riffles in Clearwater Creek, WA. Experiment 1 was conducted in 15 1.5-m^2 cages (6.4 mm mesh) placed over natural cobble substrate. Tadpole densities were 2, 4, 8, 16, and 32/m^2. Experiment 2 was conducted in 12 0.3-m^2 PVC troughs (6.4 mm mesh) to see if similar results would be obtained under more artificial conditions. Densities were 3, 6, 13, and 26/m^2. Tadpole growth and periphyton abundance decreased with tadpole density in both experiments. Activity was positively related to density in Experiment 2 but showed no relationship in Experiment 1. Abundances of the six most common large (= 3 mm) invertebrate grazers were strongly related to current speed, but the density of only *Baetis* mayflies was correlated with tadpole density. Results support the hypotheses that tadpole growth, activity, and emigration are density dependent, but are not consistent with the hypothesis that tadpole density influences other stream herbivores.

Spalding, Shelley. **Bull Trout: Big Beautiful Fish in Small Pristine Waters.** U.S. Fish and Wildlife Service, Lacey, WA.

Bull trout are a member of the family Salmonidae and of the genus *Salvelinus*, commonly known as char. Bull trout and Dolly Varden were considered to be one species until 1980 when they were distinguished based on distribution and morphology. Recent genetic work has confirmed this distinction. Bull trout are among the most cold water adapted salmonids and require very cold water for incubation, juvenile rearing and to initiate spawning. Bull trout may be either resident or migratory. All life history types tend to use the headwaters or tributaries for spawning, but migratory bull trout may be either fluvial, adfluvial or anadromous for much of their adult life. Migratory adult bull trout are piscivorus and tend to be opportunistic when in search of prey. Bull trout have been identified as a species of concern for a number of years by different state agencies and the American Fisheries Society. In 1998, bull trout in the Columbia River basin and the Klamath River basin were listed as threatened under the Endangered Species Act. In 1999, the Jarbidge, Coastal-Puget Sound, and St. Mary - Belly River population segments were also listed as threatened, resulting in bull trout being listed under

the Endangered Species Act throughout their entire range in the coterminous U.S. Threats identified for bull trout included habitat degradation and fragmentation, introduced species such as brook trout, and dams.

Stauffer, H.B., Zabel, C.J., and Dunk, J.R. **A new paradigm for model selection and inference using AIC and empirical Bayesian methodology, with application to spotted owl habitat selection modeling in California.** U.S. Forest Service, Redwood Sciences Laboratory, Arcata, CA.

We describe a new paradigm for model selection and inference, using Akaike's Information Criterion (AIC) for model selection and an empirical Bayesian methodology to obtain estimates of model uncertainty and unconditional estimates of model parameters. This approach is recommended over the traditional univariate, stepwise, and best subsets regression approaches to model selection. A parsimonious a-priori selection of candidate models is used at the beginning of the analysis process and bootstrapping techniques are used at the conclusion. The application of this new approach will be illustrated with a collaborative project between U.S. Forest Service research scientists and U.S. Fish and Wildlife Service managers, modeling spotted owl (*Strix occidentalis*) habitat selection in California. Our project examined models incorporating total quantity, edge, and core amounts of nesting-roosting and foraging owl habitat, at varying spatial scales. Several representative data sets were used for the analysis, one for the development of the models, and the others for testing. The findings of this project are now being implemented by managers for federal forestlands in California.

Steele, Craig A.[1], Edmund D. Brodie[1], Jr., and James G. MacCracken[2]. **Response of Stream-Breeding Amphibians to Timber Harvest in the Southern Cascades of Washington.** [1]Dept. of Biology, Utah State Univ., Logan, Utah, [2]Longview Fibre Company.

Because the ranges of stream-breeding amphibians occur partly on industrial timberlands in the PNW, it is valuable to study population distribution of these animals in environments that rarely reach old growth status and are subject to intensive harvest management on a regular basis. To determine how density of stream-breeding amphibians changes after timber harvest in such forests, first-order streams located on private industrial timberlands in Skamania County, Washington, were sampled during the summers of 1998 and 1999. Species captured included Dicamptodon tenebrosus, D. copei, Rhyacotriton cascade and Ascaphus truei. Regression Tree Analysis showed that captured individuals could be grouped into several forest age classes. The results indicate that Rhyacotriton cascade and Dicamptodon copei were most common in middle aged forests while D. tenebrosus was not consistently associated with any forest age class. Because of a small number of captures,

Stinson, Steve. **The Family Forest Conservation Project**. Family Forest Conservation Project, Chehalis Washington.

Non-industrial private forest (NIPF) lands represent about 18% of the available forestland in Washington State. Often these lands are located in lower drainages along critical riparian habitats. Over the last 10 years, 100 acres a day (56 square miles) of NIPF land has been converted to non-forest use on an annual basis. The primary force behind this conversion has been regulatory instability.

The Family Forest Conservation Project: A Lewis County Washington Pilot Project for Non-industrial Private Forests is developing a process to provide landowners with a scientifically defensible long term management plan. The cornerstone of this effort is a programmatic Habitat Conservation Plan.

Vander Haegen, W. Matthew. **Seasonal fecundity and nesting success of shrub-steppe passerines in altered landscapes.** Washington Dept. of Fish and Wildlife, Olympia, WA.

The landscape of the intermountain west has changed dramatically in the last 150 years, particularly within the semi-arid shrubland and grassland ecosystems. Anthropogenic change in shrub-steppe communities has been especially severe in Washington where over half of the native shrub-steppe has been converted to agricultural lands, resulting in a fragmented landscape with few extensive tracts of shrub-steppe. During 1996-1998 I examined reproductive success of passerines on study sites in fragmented and continuous shrub-steppe landscapes in eastern Washington. Parasitism rates, predation rates, and fledging success were documented for 1,240 nests. Seasonal fecundity of color-banded males of two focal species was estimated by documenting

reproductive status at weekly intervals throughout the nesting season. Parasitism rates were low (<8%) and parasitism had little effect on productivity. Several species, including 3 shrub-steppe-obligates, were found to have lower nesting success and/or lower seasonal productivity in fragmented landscapes. Simple demographic models using parameters measured in this study suggest that severely fragmented landscapes are acting as population sinks for some species.

Varland, Daniel E.[1], and Jack L. DeLap[2]. **Raptor Monitoring Along the Outer Coast of Washington, 1995-1999.** [1] Hoquiam, WA, [2]Dept. of Fishery and Wildlife Biology. Colorado State Univ., Fort Collins, CO.

Between 1995 and 1999, 186 line transect surveys by vehicle for raptors were conducted on three Washington beaches. Nine raptor species were observed at beaches at Ocean Shores, Grayland and Long Beach, with the Peregrine Falcon, Merlin, Northern Harrier and Bald Eagle being most common. On occasion, the Red-tailed Hawk, Rough-legged Hawk, Gyrfalcon, Coopers Hawk and Snowy Owl were also observed. Thirty-eight Peregrine Falcons were banded and color-marked during the surveys or at other times, and 88 re-observations of these color-marked individuals were made.

Varland, Daniel E. **Forest Management for Spotted Owls on Rayonier Lands of the Olympic Peninsula: The Wildlife Plan Area.** Rayonier, Hoquiam, WA.

The Wildlife Agreement between the Washington State Dept. of Fish and Wildlife and Rayonier for 66,000 acres of Rayonier land on the northwest Olympic Peninsula is designed primarily to create Spotted Owl dispersal habitat between the Olympic National Park Interior and the park Coastal Strip. Through this cooperative agreement, Rayonier is: performing landscape management practices to create more dispersal habitat and is co-sponsoring a snag research program to provide more habitat for bird and mammal species. The duration of the agreement is 30 years, with options for two extensions of 10 years each.

Vogel, William O. **First HCPs, then No Surprises, what's next?** U.S. Fish and Wildlife Service; Lacey, WA.

The first Habitat Conservation Plan (HCP), San Bruno Mountain, was used as a model by Congress to amend the Endangered Species Act (ESA) while that HCP was still being completed. In the years following completion, it gave us a valuable lesson regarding monitoring completed projects. Even though most people think of them as recent developments, No-Surprises-like language and assurances for unlisted species were included in that first HCP. Another early HCP, for the Coachella Valley fringe-toed lizard, taught us a lesson about risk management and unforeseen circumstances. For nearly 2 decades, the Service has accomplished much of its private-land ESA conservation objectives through the use of HCPs. Although additional tools (e.g., Candidate Conservation Agreements with Assurances and Safe-Harbor Agreements) have recently been developed under section 10 of the ESA, HCPs have the flexibility to address many of the same objectives as these new tools. Nevertheless, the ultimate goals of the Service remain unchanged. Many of the HCP concepts being presented in recent policies have always been part of the HCP program; however, we are now elevating their visibility at an appropriate time. The U.S. Fish and Wildlife Service and the National Marine Fisheries Service are emphasizing several concepts in an addendum to the HCP handbook. These concepts include, among others, incorporating biological objectives, adaptive management, and monitoring into HCPs and other conservation planning documents. With the growth of HCPs in Washington State since 1994, it is timely for the Service to formalize its commitment to monitoring in fulfilling its obligations to the public and the public's resources.

Vredenburg, Vance T. **Experimental test of non-native fish effects on mountain yellow-legged frogs: hope for amphibian recovery?** Museum of Vertebrate Zoology and Dept. of Integrative Biology. Univ. of California Berkeley, CA

A puzzling aspect of amphibian declines is that amphibians, particularly frogs, have been declining even in large protected areas. These habitats are generally thought to be relatively unaltered and undisturbed. However, the introduction of non-native fish is a common practice throughout the world, and may be an important cause of declines. In the Sierra Nevada, California, the mountain yellow-legged frog has disappeared from >80% of its historic habitat during the past century. Recent surveys indicate that the distributions of introduced trout and mountain yellow-legged frogs are non-overlapping. To test the hypothesis that introduced trout were

driving this pattern, a fish-removal experiment was conducted over a four-year period. Frogs quickly recolonized the fish-removal lakes from nearby source populations, while numbers of frogs in fish containing control lakes remained low and constant. These data suggest that in some areas, the removal of exotic species may be sufficient to reverse the decline of some amphibians.

Wagner, R. Steven, and Susan M. Haig. **Phylogeographic variation, genetic structure and conservation unit designation in forest-associated terrestrial salamanders: the Oregon Slender Salamander and the Larch Mountain Salamander.** Genetics Program and USGS-Forest and Rangeland Ecosystem Science Center, Oregon State Univ., Corvallis, OR.

In the PNW, geographic barriers arise by a complex history of glaciation, flooding, and volcanism that can fragment forest communities of the western slopes of the Cascades. These forests are impacted not only by historic geologic and ecological processes but are increasingly fragmented by forest management practices and rural development. Forest-associated species with limited dispersal capabilities may be threatened by this increased fragmentation. Therefore, to understand the potential impacts of historic versus anthropogenic fragmentation processes, we investigated the phylogeographic variation and genetic structure in two forest-associated terrestrial salamanders, the Oregon Slender Salamander (*Batrachoseps wrighti*) and the Larch Mountain Salamander (*Plethodon larselli*). We analyzed 19 populations (N = 381) of the Oregon Slender Salamander (*Batrachoseps wrighti*) and 12 populations (N = 184) of the Larch Mountain Salamander using mitochondrial DNA sequences (cytochrome *b*) and randomly amplified polymorphic DNAs (RAPDs). Both species showed significant population structure and differentiation across local and regional scales. Population subdivision estimates for both the Oregon Slender Salamander ($F_{ST} = 0.31 \pm 0.03$) and the Larch Mountain Salamander ($F_{ST} = 0.45 \pm 0.07$) were significant, suggesting a reduced amount of gene flow between populations. Based on Moritz's (1994) criteria for designating conservation units, Oregon Slender Salamanders appear to be comprised of two Evolutionary Significant Units. For Larch Mountain Salamanders, the mtDNA and RAPD analyses indicated significant differences between northern and southern populations delineated by the Columbia River, suggesting separate Management Units for these groups may be warranted.

Warheit, Kenneth I.[1], Vicki L. Friesen[2], and Tim P. Birt[2]. **Geographic Structure to Common Murre populations from British Columbia to California.** [1]Washington Dept. of Fish and Wildlife, Olympia, WA. [2]Queen's Univ., Kingston, ON, Canada.

Many seabird management activities assume a particular geographic structure to a given population, and this is especially true when assessing injury and designing restoration actions following anthropogenic events such as oil spills. In the eastern Pacific Common Murres breed from central California north to British Columbia, and within this stretch of coastline they are considered to be highly philopatric. That is, adult birds are thought to return to natal colonies to breed, thereby producing isolated or semi-isolated colonies. Common Murre is also a species most vulnerable to oil spills, and although there have been several management plans and many oil spill-related injury assessments and restoration plans developed for Common Murres, there has been no real attempt to delimit the population boundaries of this species in this area. We used molecular genetic data to determine if the Common Murre populations from British Columbia south to California are distinct, and to assess the level of gene flow among local breeding units. Microsatellite and mtDNA sequence data indicate that these populations are not distinct, and although this species may be somewhat philopatric, there appears to be considerable gene flow among local breeding units. Based on these data we recommend that management plans, including injury assessment and restoration activities, be applied at the appropriate spatial scale rather than based on political boundaries (e.g., states) or conveniently discrete units (e.g., colonies).

Watson, James W., and D. John Pierce. **Satellite telemetry studies of bald eagles in Washington State.** Washington Dept. of Fish and Wildlife, Olympia, Wash. *(Poster)*

Since 1994, movements of 36 bald eagles have been monitored through satellite telemetry in Washington State. Studies of 10 eagles captured during the nesting season provided new information on juvenile and non-breeding adult movements, home range use, and long-range migratory movements to British Columbia and southeast Alaska. Wintering studies of 26 adults captured on the Skagit River identified breeding origins in Canadian provinces and Alaska. Sixty-three percent of 13,236 locations were useful for interpretation of long-range movements. Preliminary analysis of home ranges of four adults assessed by satellite telemetry and

compared to VHF telemetry locations collected on the ground suggested that PTT (platform transmitter terminal) locations identified core areas of use, but overestimated range size and provided little useful information on specific perch locations. No reproductive differences were found between eagles with PTTs and those with conventional VHF transmitters. No physical effects were detected on eagles with PTTs. Advantages of satellite technology over conventional VHF telemetry included the relative quality and quantity of information gathered. Challenges included the recovery of downed PTTs, and relatively high cost/individual animal.

Weaver, George W., Deanna H. Olson, Loretta L. Ellenburg and Bruce P. Hansen. **Sampling designs for aquatic vertebrates in managed headwater streams.** PNW Research Station, USDA Forest Service, Corvallis, OR.

In managed headwater streams, we investigate the variation in relative abundance of stream vertebrate species at several spatial scales (between-basin; reach within basin; habitat unit within reaches) and between wet and dry seasons. Two survey objectives will be considered: characterization of the landscape scale distribution of a species or of a vertebrate community; and habitat-based inventory for a particular species. Our results indicate that for *Dicamptodon tenebrosus, Rhyacotriton variegatus, Taricha granulosa* and *Plethodon dunni* residing in discontinuous headwater stream channels, differences between streams within basins constitute the largest component of variability in relative abundance, followed by differences between basins. Thus efforts to maximize number of streams sampled and number of basins surveyed are effective approaches for landscape-scale assessment of species in this portion of the stream network. The observed variation between streams within basins is partially explained by differences in hydrologic and geomorphic attributes of the reaches and the subsequent correlation of these attributes with relative abundance for some species. For vertebrates residing in continuously wet stream channels (i.e. perennial), basin differences were the largest for *Ascaphus truei* and *D. tenebrosus*, and seasonal differences secondarily for *A. truei* and salmonids/fish, having higher dry season abundances. Vertebrate captures on the banks of stream channels have similar patterns but with more captures in the wet season, especially for *Plethodon dunni*. We interpret these results in the context of allocation of sampling effort at the basin, reach and within reach spatial scales and provide minimum effort recommendations for species inventories.

Welsh, Hartwell H. Jr.[1], Garth R. Hodgson[1], Maureen F. Roche[2], and Bret C. Harvey[1]. **Distribution of Juvenile Coho Salmon (*Oncorhynchus kisutch*) in Relation to Water Temperatures in Tributaries of a Northern California Watershed: Determining Management Thresholds for An Impaired Cold-water Adapted Fauna.** [1]USFS-PSW Redwood Sciences Laboratory, Arcata, CA, [2]Mattole Salmon Group, Petrolia, CA.

In an attempt to define the "thermal niche" of coho salmon, we examined the relationship between the presence/absence of this species and summer temperature regime in 21 tributaries of the Mattole River in northwestern California. We characterized the temperature regime of each tributary by determining the highest average of maximum daily temperatures over any 7-d period and the highest average of average daily temperatures over any 7-d period, using measurements recorded every hour throughout the summer. Coho presence/absence was determined by divers in later summer. Both variables used to describe temperature regime effectively predicted the presence/absence of coho salmon in separate logistic regressions: both correctly predicted presence/absence in 18 of the 21 streams, given a 50% probability of coho salmon presence. Temperature regimes in the warmest tributaries containing coho salmon, combined with historic and current watershed conditions which affect stream temperatures, suggest that management strategies to restore and conserve coho salmon in the Mattole Drainage should focus on water temperature regimes. Such a focus is also likely to benefit other declining species requiring cool water, including the tailed frog and southern torrent salamander.

Wessell, Stephanie J. **Terrestrial amphibian responses to aerially applied forest fertilizers**. PNW Research Station, USDA Forest Service and Dept. of Fish and Wildlife, Oregon State Univ., Corvallis, OR.

Intensive forest management practices are commonly employed to enhance the growth and yield of coniferous forests in the PNW. Among these silvicultural practices is the application of nitrogen-based chemical fertilizers. Results from recent studies indicate that nitrogenous compounds can elicit negative physiological responses in aquatic amphibians, including disruption of ion balance, inhibited fertilization and embryonic development, and diminished growth and survival. However, parallel research examining fertilizer effects on

terrestrial amphibians is lacking. We conducted a retrospective study in commercially thinned Douglas-fir second-growth stands in the Oregon Coast Range to evaluate the potential effects of aerially applied urea fertilizer on terrestrial amphibians. Study areas were comprised of three control sites receiving no fertilizer and three treatment sites receiving fertilizer applied at a rate of 488 kg urea/ha (224 kg nitrogen/ha). Habitat and amphibians were sampled six months post-treatment in spring 1999. Transect surveys resulted in the capture of a total of 47 amphibians at a rate of 0.010 captures/m^2. *Ensatina eschscholtzii* comprised the majority of amphibian captures (n=40) at a rate of 0.008/m^2. Total amphibian capture rates were 0.012/m^2 on control sites and 0.008/m^2 on treated sites. *Ensatina* capture rates were 0.011/m^2 on control sites and 0.006/m^2 on treated sites. Preliminary results indicate a moderate positive correlation of total *Ensatina* captures and soil pH at the capture site, predominantly negative correlations of total captures and coniferous downed wood volume, and positive correlations of total captures and hardwood downed wood volume.

West, Stephen D. **Responses of small mammal populations to riparian buffers in western Washington**. College of Forest Resources, Univ. of Washington, Seattle, WA.

Habitat occupancy patterns and relative abundance of small mammals within riparian zones and uplands were documented 2 years before and after harvest on six control sites, on six sites harvested under Forest Practices guidelines, and on six modified harvests. Snap and pitfall traps captured 9,163 individuals of 18 species. On riparian transects species richness and evenness did not differ significantly among treatments. Species composition of the riparian transects was very similar between harvest treatments. No species showed a statistically significant change in capture rate with respect to treatment on riparian transects. Knowing if species will persist that had declining trends over the 2-year post-harvest period requires additional sampling.

Whipple, David. **Washington State Landowner Landscape Plans.** Washington Dept. of Fish and Wildlife Olympia, WA.

In an effort to avoid difficult and costly species-by-species forest practices rules, the Timber, Fish, & Wildlife Coalition developed the Landowner Landscape Planning process, which was authorized by the Legislature in May 1997. This process is intended to provide private forest landowners incentives to voluntarily develop long term multi-species landscape management plans as a means to protect public resources. Landscape planning is a departure from standard forest practices rules for species and habitats. To gain experience with landscape planning that may prove useful in developing a permanent forest practices rule option, up to seven pilot plans can be developed.

Wiedemeier, Douglas J., and Horton, Scott P. **Trends in Spotted Owl and Barred Owl Detections in the Olympic Experimental State Forest from 1991 to 1999**. Washington State Dept. of Natural Resources, Forks WA.

Surveys for northern spotted owls (*Strix occidentalis caurina*) from 1991 to 1999 on and near DNR-managed lands on the western Olympic Peninsula have shown opposite trends in detection rates for spotted and barred owls (*Strix varia*). Survey effort (number of stations surveyed) ranged from a high of 4424 in 1993, to a low of 535 in 1999. Spotted owl detection rates (number of owl detections divided by the number of stations) decreased from 0.031 in 1991, to 0.009 in 1999. Barred owl detection rates ranged from 0.002 in 1993, to 0.024 in 1999.

Wilhere, George, F. **What is Knowledge Worth?: Adaptive Management in Habitat Conservation Plans**. Washington State Dept. of Natural Resources, Olympia, WA.

Habitat Conservation Plans (HCPs) entail a compromise between regulatory certainty and scientific uncertainty. This compromise is controversial because many HCPs are thought to inadequately address uncertainty. Adaptive management has been promoted as essential to natural resource management under uncertainty, however, very few HCPs incorporate genuine adaptive management. I briefly discuss adaptive management concepts and adaptive management in HCPs. I conclude that HCP applicants need better incentives for adaptive management, and I propose two such incentives: (1) HCPs should abide by a precautionary principle, and (2) knowledge that benefits a species should be mitigation for incidental take.

Wilson, Monique L.[1], and Christopher W. Thompson[2]. **Diet of Common Murres (*Uria aalge*) Collected on the Northern Outer Coast of Washington, Summer 1997.** [1]Washington Dept. of Fish and Wildlife, Tacoma, WA, [2]Washington Dept. of Fish and Wildlife, Mill Creek, WA. *(Poster)*

Common Murres (n=83) were collected from set gill nets in the near shore vicinity of Spike Rock and Shi Shi Bay on the northern Washington coast between 24 June and 9 July, 1997. Murre diet was composed mainly of Pacific Sand lance (72% of stomachs examined), Pacific Herring (69%), Surf Smelt (51%), Pacific Sandfish (32%), Pacific Hake (28%), squid (24%) and Pacific Tomcod (15%). Mean lengths of whole fishes indicate that murres fed primarily on juvenile (first summer) sand lance (77 mm), and age 2 (second summer) herring (148 mm) and smelt (130 mm). Prey associations in the esophagus and proventriculus (indicating recent consumption) were found to be random. Diet diversity (number of prey species) was low (one or two species; 60% of stomachs examined) when the esophagus and proventriculus were analyzed alone and increased to three and four species when the entire stomach was examined (27% and 31%, respectively). No significant differences in sex ratios were detected between age classes (subadult and adult). For most prey species, the minimum number of prey based on enumeration of otoliths and beaks was one or two individuals in the entire stomach. Diet was random with respect to sex. Most (94%) murres collected exhibited a brood (incubation) patch. Diet was random with respect to brood patch development suggesting no prey selection for murres actively raising young versus post reproductive.

Zabel[1], Cynthia, Jeffrey Dunk[1], Howard Stauffer[1], Lynn Roberts[2], and Barry Mulder[3]. **Analysis of the Effectiveness of Various Northern Spotted Owl Definitions at Predicting their Presence or Absence in California.** [1]USDA Forest Service, PSW, Redwood Science Lab, Arcata, CA. [2]USDI Fish and Wildlife Service, Arcata, CA. [3]USDI Fish and Wildlife Service, Portland, OR.

The U.S. Fish and Wildlife Service (FWS) is currently using a definition of northern spotted owl (*Strix occidentalis*) habitat that was developed in 1994. Due to a lack of correspondence between many owl locations and mapped habitat, the FWS has proposed a new habitat definition based upon field observations. We tested the revised mapping system for accuracy and compared it with its predecessor and other alternatives. We developed a modeling process that permitted the development, testing, and comparison of such mapping systems. We used a "honeycomb" grid overlay of six ecological zones to predict potential spotted owl "core areas." An iterative process was used to position the honeycomb grid to optimally differentiate between owl and non-owl habitat. Logistic regression was used as the resource selection function for the model, using linear, pseudo-threshold, and quadratic forms for the covariates. Models were developed using data gathered from randomly chosen owl sampling sites throughout northern California. The models were tested and compared using independently collected data from eight study sites in northern California. The bias-corrected Akaike Information Criterion, along with other statistical indicators, was used to compare maps and evaluate goodness of fit. The influence of different levels of scale and resolution was examined by varying the size of the cells within the honeycomb grid. By focusing on the development of reasonable scientifically-based modeling processes for the evaluation of maps, we hope that better maps can be produced in the future for protecting preferred habitats for listed species.