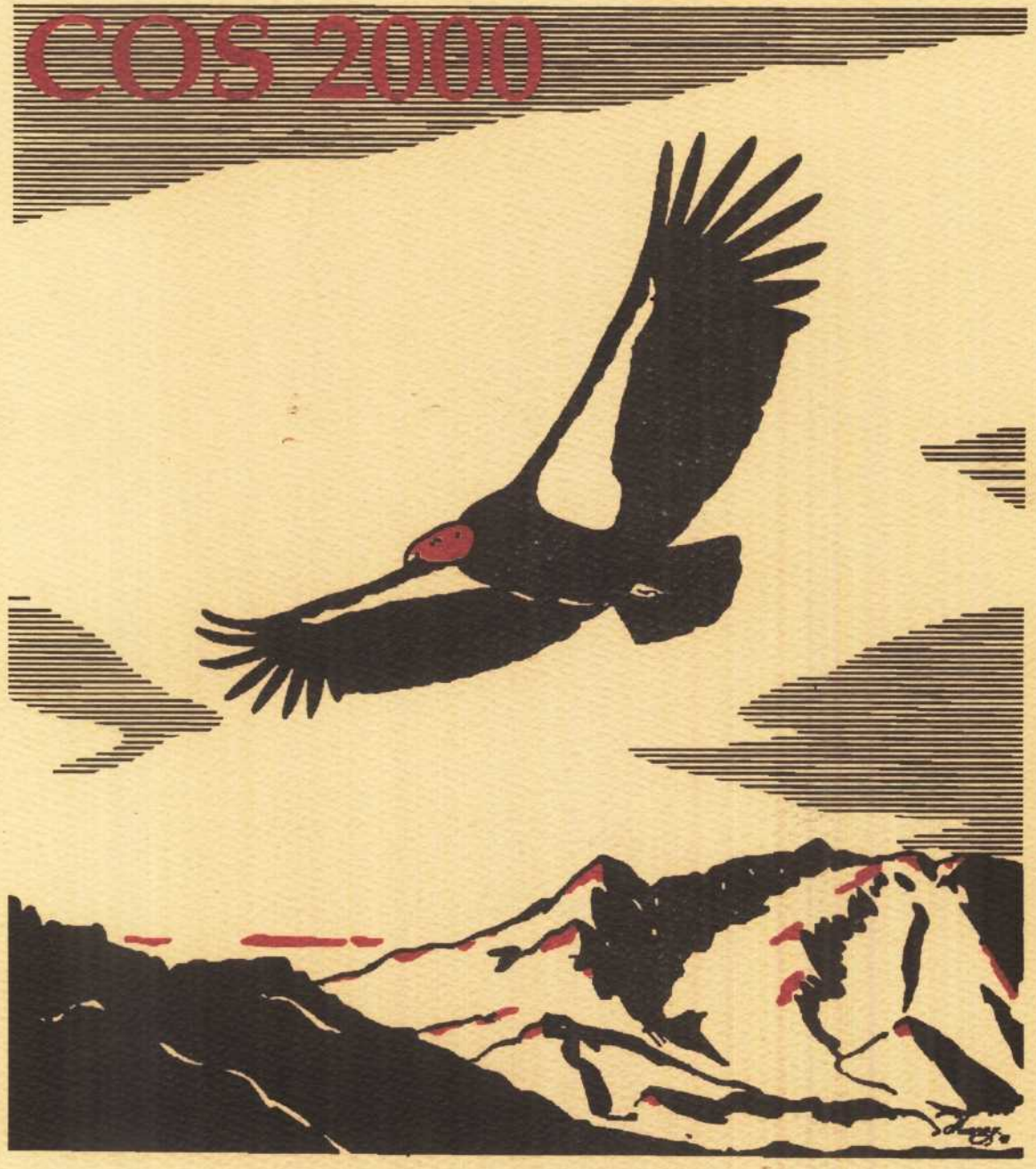

Program and Abstracts

Cooper Ornithological Society

70th Annual Meeting

25-29 April 2000

Riverside, California

Program for 70th Annual Meeting of the COOPER ORNITHOLOGICAL SOCIETY

Riverside, California, 25 – 29 April, 2000

Local Hosts

University of California, Riverside Campus
University of California Natural Reserve System
University of California Cooperative Extension

Committee on Local Arrangements

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Oxford University Press
University of Alaska Press
Thayer Birding Software

Contents

General Information

General Assistance

Welcome to Riverside, California. Local Committee Members can be distinguished by their sage green t-shirts, condor caps, and ribboned badges. General Information can be found at the registration desk, in the western foyer of the Convention Center near the main entrance.

Meeting Rooms

All meetings and session will be held in the Convention Center. COS Board Meetings (Tuesday pm and Wednesday) will be held in the Citrus Heritage Room (*upstairs*). Thursday symposia will be held in the Victoria Ballroom (Salton Sea Avifauna) and La Sierra Room (Biology of *Corvus*) (*upstairs*). Friday plenary session and Society business meeting will be in the Victoria Ballroom/De Anza Room. The Friday concurrent sessions will be held in the Arlington Room (Session A1 through 3) and La Sierra Room (sessions B1 through B3) (*both upstairs*). All paper sessions on Saturday will take place in the Victoria Ballroom/De Anza Room. Slides can be previewed in the Citrus Heritage Room, Thursday through Saturday. The plenary lecture and Saturday paper sessions will take place in the Victoria Ballroom.

Breaks

Breaks with coffee and soft drink service are scheduled every day at 10:30-11:00am and 3:00-3:30pm, served on the patio outside the Convention Center. Lunch break every day is noon-1:30pm.

Meals

A list of restaurants in the downtown Riverside area is included in your packet. Breakfast is served at the Holiday Inn and Mission Inn (two blocks south on Main Street). Lunch and dinner can be found at over 15 restaurants within 10 minutes walk south of the Convention Center. There's a Mediterranean dinner on Thursday, a mixer with hors d'oeuvres on Friday evening with the poster session, and the banquet on Saturday.

Phone messages

Phone messages will be posted on a message board, but we encourage you to use your room at the Holiday Inn for messages and contacts.

Handicapped access to Convention Center

There are elevators in the Convention Center (next to the De Anza Room) which can be used for access to upstairs and the parking lot below the Plaza. Elevators at the opposite end of this underground parking lot can be used to access the Holiday Inn lobby and rooms.

Slide Preview Room

Slides can be previewed at the Citrus Heritage Room (*upstairs*) during the regular session hours on Thursday, Friday, and Saturday.

Paper and Symposia Presentations

Four to six paper presentations are assigned to each session. Each speaker is allowed 15 minutes; 12 minutes for presentation and 3 minutes for questions. As a courtesy to other speakers, session chairs will interrupt presentations that run over 15 minutes. Slide projectors and overhead projectors will be available in the meeting rooms. *Please let your session chair know that you are present and turn your slides into the slide preview room at least 15 minutes before the start of your session.*

Poster Presentations

Posters will be set-up on exhibit boards in the eastern foyer and inside the Magnolia Room. Posters can be set anytime after 4:00 pm on Wednesday afternoon, and can remain on exhibit until 3:00 pm on Saturday. Each poster area is 4ft tall by 6 ft long, and is numbered to match the abstract number in your program.

Vendors/Exhibitors

Vendors and Exhibitors will be housed in the Magnolia Room, which doubles as the anteroom for the Victoria Ballroom. Hours of display will be: Thursday, 9:00 to 17:00; Friday, 8:30 to 21:00; Saturday 9:00 to 16:00.

Early Morning Birding

Field trips to local birding hotspots are scheduled every morning, from 6:30 to 9:00 pm. Vans will leave from and return to the front of the Holiday Inn. Dress warmly but layer clothing as the mornings in Riverside start cold but can quickly heat up.

T-shirts and Caps

A limited number of COS 2000 T-shirts and baseball caps are available in the western foyer of the Convention Center (at the ticket booth) across from the registration desk. T-shirts sell for $12 ($15 for long-sleeved) and caps for $15.

Meeting Logos

The logo for the meeting was designed by Kathy Koehler (California Thrasher proposed by Melissa Preston). The program design was created by John Rotenberry and Bill Kristan from a previous cover of THE CONDOR.

Field Trips

Extended field trips will meet in the lobby and depart from the front of the Holiday Inn across from the Convention Center at 6:00am.

Social Events

Tuesday, 25 April

6:30-8:30pm **COS** *Board Dinner*

Wednesday, 26 April

7:00-10:00pm *Welcome Reception, Convention Center Plaza*

Thursday, 27 April

6:00-10:30pm *"Mediterranean Dinner" at UCR's Botanical Garden*

Friday, 28 April

6:30-10pm *Poster Session and Social, East Foyer of the Convention Center*

Saturday, 29 April

5:30-6:30pm *Student Reception with COS Board of Directors*

6:30-10:00pm *Reception, Banquet, and Awards.*
Guest Speakers: Lloyd Kiff and Ray Quigley,

"The Cooper Club and the Condor"

Cooper Ornithological Society
Scientific Program

General Meeting Schedule

Tuesday, 25 April

1:00-5:30pm	**COS** Board Meeting, *Citrus Heritage Room*

Wednesday, 26 April

9:00am-5:30pm	**COS** Board Meeting, *Citrus Heritage Room*

Thursday, 27 April

9:15am-4:30pm	*Symposium*: Ecology and Conservation of Avifauna of the Salton Sea, *Victoria Ballroom*
9:15am-3:00pm	*Symposium:* Biology and Management of the Genus *Corvus, La Sierra Room*
3:30-5:00pm	*Working Group*: Partners in Flight - Monitoring and Inventory

Friday, 28 April

9:00-10:30am	*Plenary*: Dr. Tom Martin, "Challenging perspectives in life history evolution: insights from local versus global comparisons," *Victoria Ballroom*
11:00am-noon	*Contributed Paper Session A1*: Migration, *Arlington Room* *Contributed Paper Session B1*: Song, *La Sierra Room*
1:30-2:00pm	**COS** General Business Meeting (all Members)
2:00-3:00pm	*Contributed Paper Session A2*: Systematics, *Arlington Room* *Contributed Paper Session B2*: Nest Selection and Depredation, *La Sierra Room*
3:30-5:00pm	*Contributed Paper Session A3*: Conservation, *Arlington Room* *Contributed Paper Session B3*: Physiology and Disease, *La Sierra Room*
6:30-10pm	*Poster Session and Social, East Foyer of the Convention Center*

Saturday, 29 April

9:00-10:30 am	*Contributed Paper Session C1*: Foraging Behavior and Ecology, *Victoria Ballroom*
11:00 am-noon	*Contributed Paper Session C2*: Population Ecology, Climate, and Season, *Victoria Ballroom*
1:30-4:45 pm	*Contributed Paper Session C3, C4:* Habitat Relationships and Conservation, *Victoria Ballroom*

** Denotes eligibility for student presentation award

Symposium

Ecology and Conservation of Avifauna of the Salton Sea

Thursday, 27 April

9:15 Introductory remarks. *MICHAEL A. PATTEN, Department of Biology, University of California, Riverside, CA., KATHY C. MOLINA, Section of Vertebrates, Natural History Museum of Los Angeles County, Los Angeles, CA; W. DAVID SHUFORD, Point Reyes Bird Observatory, Stinson Beach, CA.

9:45 History of ornithological exploration of the Salton Sink. *KIMBALL L. GARRETT and KATHY C. MOLINA, Section of Vertebrates, Natural History Museum of Los Angeles County, Los Angeles, CA; MICHAEL A. PATTEN, Department of Biology, University of California, Riverside, CA.

10:00 A bird's-eye view of avian habitats at the Salton Sea. * TIMOTHY P. KRANTZ and STEVE HOOVER, Salton Sea Database Program, Center for Environmental Management, University of Redlands, Redlands, CA.

10:15 Migration of landbirds through desert riparian habitats of the Salton Sea and its environs. *SUSAN L. GUERS, MAUREEN E. FLANNERY, GEOFFREY R. GEUPEL, and NADAV NUR, Point Reyes Bird Observatory, Stinson Beach, CA.

10:30 BREAK

11:00 Winter relative abundance and spatial use of the Salton Sea by selected waterbirds. *ROBERT L. MCKERNAN, Biol. Section, San Bernardino Co. Musm., Redlands, CA; JOSEPH R. JEHL, JR., Hubbs-Sea World Resr. Inst., San Diego, CA.

11:15 Waterbirds and wetland conservation in the Colorado River delta, Mexico. *OSVEL HINOJOSA-HUERTA, Sch. of Renewable Natl. Resr. Univ. of Arizona; CARLOS VALDES-CASILLAS, Cent. for Conserv. of Natl. Resr. (CECARENA), ITESM Campus Guaymas, Sonora, Mexico; STEPHAN DESTEFANO, Mass. Coop. Fish and Wildl. Resr. Unit, Univ. of Mass.

11:30 Trace element and organochlorine contamination in prey and habitat of the Yuma Clapper Rail in Imperial Valley. CAROL A. ROBERTS, U.S. Fish and Wildlife Service, Carlsbad, CA.

11:45 The ecology of Burrowing Owls in the Imperial Valley, California. *DANIEL K. ROSENBERG and KATHERIN L. HALEY, Dept. of Fisher. and Wildl., Oregon St. Univ.; DAVID F. DESANTE and ERIC D.RUHLEN, the Inst. for Bird Pop., Pt. Reyes St., CA; MELISSA M. YORK, NOELLE RONAN, and JENNIFER A. GERVAIS, Dept. of Fisher. and Wildl., Oregon St. Univ.; KEN K. STURM, Sonny Bono Salton Sea Natl. Wildl. Refuge, Calipatira, CA.

12:00- 2:00 LUNCH

2:00 The Salton Sea as important waterfowl habitat in the Pacific flyway. *DOUGLAS A. BARNUM, U.S. Geological Survey, Delano, CA; STEVEN JOHNSON, U.S. Fish and Wildlife Service, Sonny Bono Salton Sea National Wildlife Refuge, Calipatria, CA.

2:15 Patterns of shorebird use of the Salton Sea, California. *W. DAVID SHUFORD, Point Reyes Bird Observatory, Stinson Beach, CA; ROBERT L. MCKERNAN, San Bernardino County Museum, Redlands, CA; NILS WARNOCK, Point Reyes Bird Observatory, Stinson Beach, CA.

2:30 Status of pelagic and subtropical waterbirds at the Salton Sea. *GUY MCCASKIE, Imperial Beach, CA; MICHAEL A. PATTEN, Department of Biology, University of California, Riverside, CA.

2:45 Avian range expansions and population changes in the Salton Sink during the past quarter-century. *MICHAEL A. PATTEN, Department of Biology, University of California, Riverside, CA; RICHARD A. ERICKSON, LSA Associates, Irvine, CA.

3:30 Salton Sea breeding larids: population trends, colony sites and conservation. KATHY C. MOLINA, Section of Vertebrates, Natural History Museum of Los Angeles County, Los Angeles, CA.

3:45 The breeding birds of Isla Montague, Delta Del Río Colorado, México: apparent variations at different temporal scales. ERIC MELLINK, Centro de Investigación Científica y de Educación Superior de Ensenada, Ensenada, BC, México.

4:00 Closing remarks. *W. DAVID SHUFORD, Point Reyes Bird Observatory, Stinson Beach, CA; MICHAEL A. PATTEN, Department of Biology, University of California, Riverside, CA., KATHY C. MOLINA, Section of Vertebrates, Natural History Museum of Los Angeles County, Los Angeles, CA.

Symposium

Biology and Management of the Genus *Corvus*

Thursday 27 April

9:15 Introduction. WILLIAM I. BOARMAN, United States Geological Survey.

9:30 Evolutionary genetics of *Corvus*: more than meets the eye. *ROBERT FLEISCHER, KEVIN OMLAND, CARL MCINTOSH, Natl. Zool. Park, Smiths. Inst., Wash., DC; CHERYL TARR, Dept. of Biology, Penn. State Univ., State College, PA; WILLIAM BOARMAN, USGS, UC Riverside, CA; FERN DUVALL, Hawaii DLNR-Dept. of For. and Wildl., Maui, HI; JOHN MARZLUFF, Dept. of Ecosystem Sciences, Univ. of Wash., Seattle, WA.

10:15 Raven intelligence tests. BERND HEINRICH, Department of Zoology, University of Vermont, Burlington, VT.

10:30 BREAK

11:00 Even crows find island life challenging. *JOHN M. MARZLUFF, College of Forest Res., Univ. of Washington, Seattle, SCOTT R. DERRICKSON, Natl. Zool. Park, Front Royal, VA.

11:30 Mortality in the American Crow attributed to West Nile virus. *LINDA C.GLASER, USGS Nat. Wildl. Health Center, WI; WARD STONE, N.Y. Dept. of Environ. Conservation, NY; ROBERT G. MCLEAN, LOU SILEO, DOUGLAS E. DOCHERTY, and WALLACE HANSEN, USGS Nat. Wildl. Health Center, WI

12:00 LUNCH

1:30 A review of the expansion of range of the House Crow (*Corvus splendors*), the impacts of its colonization and strategies used in its control. COLIN RYALL, School of Environmental Management, Farnborough College, Hampshire, UK.

2:00 Responses of crows and ravens to human settlement and recreation: are corvids harbingers of death or agents of destruction? JOHN M. MARZLUFF and *ERIK A. NEATHERLIN, College of Forest Resources, University of Washington, Seattle, WA

2:30 Common Ravens As Subsidized Predators. WILLIAM I. BOARMAN, U.S. Geological Survey, Department of Biology, University of California, Riverside, Riverside, CA

Contributed Papers
Friday 28 April

Concurrent Session A1: Migration – Mary Whitfield, Chair

11:00 Timing of breeding range occupancy among high latitude passerine migrants. *ANNA-MARIE BENSON, Alaska Bird Observatory, P.O. Box 80505, Fairbanks AK, 99708; KEVIN WINKER, University of Alaska Museum, 907 Yukon Drive, Fairbanks AK.

11:15 Using stable isotopes of hydrogen in feathers and precipitation to estimate the natal latitudes of immature Cooper's Hawks migrating throughout the Florida Keys. *TIMOTHY D. MEEHAN, Dept of Wildl., HSU, CASEY A. LOTT, Hawk Watch Internatl., ZACHARY D. SHARP, Dept. of Earth and Planetary Sci., UNM, ABQ, RUTH B. SMITH, Hawk Watch International., ROBERT N. ROSENFIELD, Dept of Biology, UW, Stevens Point, WI; ANDY STEWART, Victoria, BC.

11:30 Winter distribution surveys of the Willow Flycatcher in Panama and El Salvador. *JANET C. LYNN; MARY J. WHITFIELD, Kern River Research Center, Weldon, CA.

11:45 Guild structure of the Guandaushi avian community in non-breeding seasons. SHAO-PIN YO, Dept. of Zool., Natl. Chung Hsing Univ., Taichung Taiwan.

12:00 LUNCH

1:30 Business Meeting

Concurrent Session A2: Systematics – Kimball Garrett, Chair

2:00** Molecular phylogenetics of the kingbirds and their allies. JASON A. MOBLEY; Musm. of Vert. Zoology and Dept. of Integrative Biology, Univ. of California, Berkeley, CA.

2:15** Interhemispheric colonization and phylogenetic relationships in the avian family Bombycillidae. *GARTH M. SPELLMAN and KEVIN S. WINKER, Dept. of Biol. and Wildl., University of Alaska Museum, University of Alaska, Fairbanks, AK.

2:30** Molecular genetic structuring and demographic history of the Willow Flycatcher. EBEN H. PAXTON, Northern Arizona University and USGS-FRESC, Colorado Plateau Field Station, Flagstaff, AZ.

2:45 Comparative phylogeography of the breeding landbirds of the Aleutian Islands. *CHRISTIN L. PRUETT AND KEVIN S. WINKER, University of Alaska Museum and Department of Biology and Wildlife, University of Alaska, Fairbanks, AK.

3:00 BREAK

Contributed Papers
Friday 28 April

Concurrent Session B1: Song – Arch McCallum , Chair

11:00** Song variation in an avian ring species. DARREN E. IRWIN, Department of Biology, University of California, San Diego, La Jolla, CA.

11:15 Reconstructing the primitive vocal repertoire of the Paridae: commonalities of two clades. Arch McCallum, Dept. of Biology, College of Charleston, SC.

11:30** Vocal communication in the Brewer's Sparrow. *BRETT L. WALKER and ERICK P. GREENE, Division of Biological Sciences, University of Montana, Missoula, MT.

11:45** A potential 'password' for species recognition in a brood parasitic bird, the Brown-Headed Cowbird. MARK E. HAUBER, Field of Neurobiology and Behavior, Cornell University, Ithaca, NY.

12:00 LUNCH

1:30 Business Meeting

Concurrent Session B2: Nest Selection and Depredation – Luke George, Chair

2:00 Nest predators and nesting success of the Dusky Flycatcher in a managed ponderosa pine forest. *JOSEPH LIEBEZEIT and T. LUKE GEORGE, Dept. of Wildl., Humboldt State Univ., CA.

2:15** Nest site selection and nest success in a Song Sparrow population breeding in two habitats. MARY K. CHASE, Dept. of Biology, Univ. of California, Riverside.

2:30 The statistical analysis of nesting success using time-to-failure analysis, an alternative to the Mayfield method: an example using Loggerhead Shrikes. *NADAV NUR, AARON HOLMES, and GEOFFREY R. GEUPEL, Point Reyes Bird Observatory, Stinson Beach, CA; KENT LIVEZEY, U.S. Navy, Engineering Field Activity NW, Poulsbo, WA; RUSS MORGAN, Oregon Department of Fish and Wildlife, Heppner, OR.

2:45** Nest site selection and nest predation in an early successional habitat. *JAMES S. MARSHALL. Environ. Sci. and For., SUNY, Syracuse, NY.

3:00 BREAK

Contributed Papers

Friday 28 April

Concurrent Session A3: Conservation – Steve Knick, Chair

3:30** Day-night differences in habitat use and behavior by Dunlin wintering in the Fraser River Delta, Canada. LESLEY J. EVANS-OGDEN, Dept. of Biology, Simon Fraser University.

3:45 Edge effects on the nesting success of redwood forest birds. *JENNY KRANZ ALLEN, Los Banos, CA; T. LUKE GEORGE, Wildl. Dept, Humboldt State University.

4:00** Effects of urbanization on wintering bird species richness, diversity, and density in Orange County, CA. DEBBIE J. HOUSE, Dept. of Biol. Sci., California St. Polytechnic Univ., Pomona.

4:15** Lack of an urban edge effect on reproductive demography of an area-sensitive sparrow. *SCOTT A. MORRISON, Dept of Biol., Dartmouth College; DOUGLAS T. BOLGER Environ. Studies Program, Dartmouth College.

4:30** Alternative processes that produce edge effects in birds of California coastal sage scrub. *WILLIAM B. KRISTAN, JOHN T. ROTENBERRY, Dept. of Biol., UC Riverside; ANTONY J. LYNAM, Wildl. Cons. Soc.; and MARY V. PRICE, Dept. of Biol., UC Riverside.

4:45 Songbird abundance on open space grasslands in an urbanized landscape. *CARL E. BOCK, Dept. of Environ., Pop., and Organm. Biol., Univ. of Colorado, SANDRA L. HAIRE, USGS, Midcontinent Ecol. Sci. Center, Fort Collins, CO.

Concurrent Session B3: Physiology and Disease – Hugh Ellis, Chair

3:30 Egg-size variation in the Acorn Woodpecker. *WALT KOENIG, Hastings Reserv., UC Berkeley; MARK STANBACK, Dept. Biol., Davidson College, NC; JOEY HAYDOCK, Hastings Reser., UC Berkeley.

3:45** Testosterone and reproductive trade-offs in male House Finches, ANDREW M. STOEHR, Dept. of Biology, Univ. of California, Riverside.

4:00 Correlation of summit metabolism and thermogenic endurance in winter acclimatized passerines. DAVID L. SWANSON, Dept. of Biol., Univ. of South Dakota, Vermillion.

4:15 Immune responses of Eastern Bluebird (*Sialia sialis*) nestlings to parasitism by blowfly (*Protocalliphora sialia*) larvae. KRISTIN AHANNAM, Univ. of Nevada, Reno, NV.

4:30** Fat reserves in wintering Bohemian Waxwings. *JOHN P. DeLONG, J. BRIAN BURNS, and JAMES A. GESSAMAN, Depart. of Biol., Utah St. Univ., Logan, Utah.

4:45 Disease emergence in birds: challenges for the twenty-first century. *MILTON FRIEND, ROBERT G. MCLEAN, and F. JOSHUA DEIN, USGS, Biol. Res. Div., Madison, WI.

Poster Presentations

Friday Night 28 April

P1** Breeding and parental care in songbirds: an evolutionary stable set analysis. JOEL JAMES ADAMSON, Department of Environ., Pop. and Org. Biol., University of Colorado, Boulder.

P2** Timing of nesting of Roseate Spoonbills in northeastern Florida Bay compared to water management practices. *ELSA M. ALVEAR, Dept. of Biol., Sci., Florida Atlantic University,. JOHN C. OGDEN, South Florida Water Management District, Miami, Florida. SHEILA A. MAHONEY and ANNABELLE C. MCKIE, Dept. of Biol. Sci., Florida Atlantic University.

P3** Microhabitat selection by Mikado Pheasants. CARA LIN BRIDGMAN, Department of Ecology and Evolutionary Biology, University of Tennessee, Knoxville.

P4** Subspecific differentiation and genetic population structure of Song Sparrows (*Melospiza melodia*) in San Francisco Bay. YVONNE L. CHAN and PETER ARCESE, Center for Applied Conservation Biology, University of British Columbia, BC, Canada.

P5** Egg recognition behavior differences between California and Spotted towhees. *KEVIN ELLISON, Department of Zoology, University of Manitoba, Winnipeg, MB, and STEPHEN I. ROTHSTEIN, Department of EEMB, University of California, Santa Barbara, CA.

P6 Identification of Bufflehead molting sites in interior British Columbia. *MATTHEW R. EVANS, Center for Wildlife Ecology, Simon Fraser University, Burnaby, BC ANDRE BREAULT, Canadian Wildlife Service, Delta, BC.

P7 Natural cavity use by Barrow's Goldeneye and Bufflehead in British Columbia, and a comparison to nest box usage. *MATTHEW R. EVANS, DAVID B.LANK, FRED COOKE, Center for Wildl. Ecol., Simon Fraser Univ. W. SEAN BOYD, Canadian Wildl. Ser., Delta, BC.

P8 Spring arrival dates and physical condition in a declining population of Warbling Vireos. *THOMAS GARDALI, GRANT BALLARD, NADAV NUR, AND GEOFFREY R. GEUPEL, Point Reyes Bird Observatory, Stinson Beach, CA.

P9 Migration of landbirds through desert riparian habitats of the Salton Sea and its environs. *SUSAN L. GUERS, MAUREEN E. FLANNERY, GEOFFREY R. GEUPEL, and NADAV NUR; Point Reyes Bird Observatory, Stinson Beach, CA.

P10 Do highly saline environments impose a physiological stress on young American Avocets (*Recurvirostra americana*)? *KRISTINA HANNAM and LEWIS ORING Dept. of Environmental & Resource Sciences, University of Nevada, Reno, NV.

P11 Nest site selection among grassland passerines in northeastern Montana. *STEPHANIE L. JONES, USFWS, Region 6, J. SCOTT DIENI, Redstart Consulting, Evergreen, CO; PAULA J. GOUSE,U.S.F.W.S., Bowdoin Natl. Wildl. Refuge, Malta, MT.

P12 Density dependent mass gain by Wilson's Warblers during stopover. *JEFFREY F. KELLY, Rocky Mountain Research Station, Albuquerque NM; LINDA S. DELAY, New Mexico Natural Heritage Program, DEBORAH M. FINCH, Rocky Mountain Research Station, Albuquerque, NM.

P13** Morphological mechanisms of seasonal acclimatization in three species of resident passerines. *ERIC T. LIKNES and DAVID L. SWANSON, Dept. of Biol., Univ. of South Dakota.

P14 Seasonal roost flock dynamics and tree usage by naturalized parrots in the San Gabriel Valley, California. KAREN T. MABB* and MELANIE A. STALDER, Dept. of Biol., California St. Polytechnic. Univ., Pomona.

P15 Ammonotely and nitrogen excretion in three sympatric hummingbird species. TODD J. MCWHORTER, Dept. of Ecol. & Evol. Biol., Univ. of Arizona; DONALD R. POWERS, Biol. Dept., George Fox Univ; *NATHAN MILLER, Biology Department, Linfield College.

P16 Timing of clutch-initiation in relation to the tidal cycle by tidal marsh Song Sparrows: an adaptation to avoid flooding? NADAV NUR and HILDIE SPAUTZ, Point Reyes Bird Observatory, Stinson Beach, CA.

P17 Use of three song types in different contexts by Willow Flycatchers. CHRISTINE M. PAYNE, Dept. of Zool., Univ. of W. Ontario; *M. ROSS LEIN, Dept. of Biol. Sciences, Univ. of Calgary.

P18 Differences in relative abundance and species richness of birds in multiple-aged vegetation communities: implications for fire management. JENNIFER L. RECHEL, USDA Forest Service, Forest Fire Laboratory, Riverside, CA.; DAVID A. LARSON, USDA Forest Service, San Dimas Experimental Forest, Glendora, CA.

P19** Assessing breeding riparian bird abundance with different scales of habitat information. *TIMOTHY S. REDMAN, Dept. of Biol., University of California, Riverside; JOSHUA J. TEWKSBURY, Department of Zoology, University of Florida, Gainesville, FL.

P20 Microsatellite analysis of mixed mating strategies in Bank Swallows, *Riparia riparia*. *LETITIA M. REICHART and ANTHONY J. NASTASE, Department of Biology, Indiana University of Pennsylvania, Indiana, PA.

P21 Winter avian surveys in the coastal waters of San Blas, Nayarit, Mexico. *THOMAS P. RYAN, San Francisco Bay Bird Observ., DANIEL A. KLUZA, Dept of Ecol. and Evol. Biol., Univ. of Kansas, Lawrence, ARMANDO SANTIAGO, San Blas, Nayarit, Mexico.

P22** Response of a breeding bird community to a patchy forest landscape in Grand Teton National Park. GREGORY SCHROTT, Dept. of Org. Biol., Ecol., and Evol., Univ. of Cal., Los Angeles.

P23** Territorial dynamics and spatial utilization of a fragmented habitat by Coastal Cactus Wrens. CHRISTOPHER W. SOLEK, Biol. Sci. Dept., California St. Polytechnic Univ., Pomona.

P24 Nest site and microhabitat use by endangered Southwestern Willow Flycatchers on the Gila River, New Mexico. *SCOTT H. STOLESON and DEBORAH M. FINCH, USDA Rocky Mountain Research Station, Albuquerque, NM.

P25 Influence of ecological factors on the winter diet of Hermit Thrushes. CHERYL STRONG, Dept. of Biology, Southeastern Louisiana University, Hammond, LA.

P26** The hunting and nesting success of Northern Harrier (*Circus cyaneus*) in yellow star-thistle (*Centaurea solstitialis* L) at Beale Air Force Base, California. *NATASHA TUATO'O-BARTLEY, California State University, Sacramento, CA; LINNEA S. HALL, Ventura, CA.

P27** Where is the southern range limit of breeding "Timberline" Sparrows? *BRETT L. WALKER, SUZANNE A. COX, ERICK P. GREENE, Div. of Biol. Sci., Univ. of Montana, Missoula, MELISSA M. HART, Wildl. Spatl. Anal. Lab., Univ. of Montana, Missoula; STEVE J.GNIADEK, DAVID SHEA, Glacier Natl. Park; JOHN E.LUNDBLAD, Biology Department, Sonoma State University, Rohnert Park, CA.

P28 Thermal conductance and energetics of high-latitude seabirds. *W.W. WEATHERS, K.L. GERHART, AND P.J. HODUM, Avian Science Department, University of California, Davis, CA.

P29 The influence of habitat and disturbance on Burrowing Owl reproductive performance. *JASON D. WOODARD, Grad. Degree Program In Ecology, Colorado State University, Fort Collins, CO; BEATRICE VAN HORNE, Department of Biology, Colorado State University, Fort Collins, CO.

Poster Presentations of *Corvus* Symposium

C1 Development of a corvid management plan for California. *ESTHER E. BURKETT, California Department of Fish and Game, Habitat Conservation Planning Branch, Sacramento, CA.

C2 Patterns of reproductive output in Common Ravens (*Corvus corax*) relative to anthropogenic resources in the west Mojave Desert. WILLIAM B. KRISTAN III, University of California, Riverside, CA and WILLIAM I. BOARMAN, USGS Western Ecological Research Center and Department of Biology University of California, Riverside, CA.

C3 The Raven in Tennessee: a threatened species. ALLAN TRENTLY, Department of Biology, East Tennessee State University, Johnson City, TN.

C4 Raven juvenile survival in a human augmented landscape. * WILLIAM C. WEBB, Department of Biology, University of California, Riverside, CA; WILLIAM I. BOARMAN USGS Western Ecological Research Center and Department of Biology University of California, Riverside, CA.

Contributed Papers
Saturday 29 April

Session C1: Foraging Behavior and Ecology – Diana Tomback, Chair

9:00 Cache recovery accuracy by three species of seed-caching corvids in an open field. TOM GREENE, ARLA G. HILE,*RUSSELL P. BALDA, Dept. of Biol. Sci. Northern Arizona Univ.

9:15** Foraging ecology and role of pine seeds in the diet of Steller's Jay. *SARA M. BREINDEL and DIANA F. TOMBACK, Dept. of Biol., Univ. of Colorado, Boulder, CO.

9:30** Clark's Nutcracker and southwestern white pine: another bird-pine mutualism. *SHERIDAN SAMANO and DIANA F. TOMBACK, Dept. of Biol., Univ. of Colorado, Boulder, CO.

9:45** Does trophic structure morphology of the Steller's Jay (*Cyanocitta stelleri*) vary in relation to habitat type? *KIRSTIE M. BAY and DIANA F. TOMBACK, Dept. of Biol., Univ. of Colorado at Denver, CO.

10:00** Prey availability and diet in relation to post-fire habitat use by the Black-backed Woodpecker. HUGH D.W. POWELL, Div. of Biol. Sci., Univ. of Montana.

10:30** The role of foraging woodpeckers in the decay of ponderosa pine. **KERRY L. HUGHES, E.O. GARTON, Dept. of Fish and Wildl. Res., Univ. of Idaho; PATRICIA J. HEGLUND, Potlatch Corporation, Lewiston, ID; STEVE ZACK, Wildlife Conservation Society, North America Program, Hillsboro, OR.

Session C2: Population Ecology, Climate, and Season – Bette Loiselle, Chair

11:00** Relationships between arthropods and songbirds in riparian areas during fall migration. SHERRY E. HUDSON, Dept. of Biol. Sci., Univ. of Idaho, Moscow, ID.

11:15 Impacts of El Nino/Southern Oscillation events on wintering raptor densities and distributions at three scales. DANIEL H. KIM, Dept of Wildl. and Fisher. Sci., Texas A&M Univ., and Caesar Kleberg Wildl. Res. Inst., Texas A&M Univ. Kingsville, R. DOUGLAS SLACK, Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, TX, FELIPE CHAVEZ-RAMIREZ, Caesar Kleberg Wildl. Res. Inst., Texas A&M Univ. Kingsville, and WWF-Mexico.

11:30** Partitioning variance in survivorship among different phases of the annual cycle of a neotropical migrant songbird. *T. SCOTT SILLETT and RICHARD T.HOLMES, Department of Biological Sciences, Dartmouth College, Hanover, NH.

11:45 Effects of a global climate cycle on the survival and fecundity of a neotropical migrant songbird. *RICHARD T. HOLMES and T. SCOTT SILLETT, Dept. of Biol. Sci., Dartmouth College.

12:00 LUNCH

Contributed Papers
Saturday 29 April

Session C3: Habitat Relationships and Conservation – Richard Holmes, Chair

1:30 Breeding birds and upper mississippi river floodplain forests: one bird community, one habitat type? EILEEN M. KIRSCH, USGS Upper Midwest Environmental Sciences Center, La Crosse, WI.

1:45** The Botteri Sparrow: an avian habitat specialist colonizing an alien grassland in southeastern Arizona. *ZACH F. JONES and CARL E. BOCK, Dept of EPO Biol., Univ. of Colorado, Boulder, CO.

2:00** Nest site selection by Forester's Terns (*Sterna forester*). ROBIN DANKIN, San Francisco Bay Bird Observatory, Alviso, CA.

2:15** Paradise lost/paradise found? Bird use of a tropical tree plantation. JAMIE A. ROTENBERG, Dept. of Biol., Univ. of California, Riverside.

2:30 Comparing performance of species distribution models using historic records of birds in the Atlantic forests of Brazil. *BETTE A. LOISELLE, Dept. of Biol., Univ. of Missouri-St. Louis,; CATHERINE GRAHAM, Jet Propulsion Lab., Pasadena, CA.

2:45 Altitudinal migration and habitat use by dispersing, juvenile California Spotted Owls in the southern Sierra Nevada, California. ROBERT M.TIBSTRA, Dept of Biol., California St. Univ., Fresno.

3:00 BREAK

Session C3: Habitat Relationships and Conservation – Carl Bock, Chair

3:30 Large-scale patterns of bird distribution from intensive surveys. *C. JOHN RALPH and BILL HOGOBOOM, USFS Redwood Sci. Lab., Arcata, California; and JOHN ALEXANDER, Klamath Bird Observatory, Ashland, Oregon.

3:45 A new paradigm for monitoring the abundance of northern-nesting birds. *JONATHAN BART, Snake River Fld. St., USGS, Boise, ID; BRAD ANDRES and KENT WOHL, US FWS, Anchorage, AK

4:00 Are Sage Grouse an appropriate umbrella species for managing sagebrush steppe habitats? *STEVEN T. KNICK, USGS For. and Range. Ecosystem Sci. Center, Boise, ID; JOHN T. ROTENBERRY, Dept. of Biol., Univ. of California, Riverside.

4:15 Are there snags in the system? Woodpeckers and the complexities of pine decay that affect "snags per acre" management. *STEVE ZACK, Wildlife Conservation Society; T. LUKE GEORGE, Dept. of Wildl., HSU; PATRICK J. SHEA, USDA USFS-PSW, Davis, CA; WILLIAM F. LAUDENSLAYER, JR., USDA USFS-PSW, Fresno, CA.

4:30 Can habitat predict the abundance of shrubsteppe birds? A 20-year retrospective. JOHN T. ROTENBERRY, Dept. of Biol., Univ. of California, Riverside, *JOHN A. WIENS, Dept. of Biol., Colorado St. Univ., Fort Collins, CO.

Abstract of Papers and Posters Presented at the 70th Annual Meeting of the Cooper Ornithological Society

1. ***BREEDING AND PARENTAL CARE IN SONGBIRDS: AN EVOLUTIONARY STABLE SET ANALYSIS**. JOEL JAMES ADAMSON, Department of Environmental, Population and Organismic Biology, University of Colorado, Boulder, Colorado, 80309-0334

In Lark Sparrows *Chondestes grammacus*, as in many songbirds, males nest monogamously and provide parental care. To explore this, a two-stage game theory model was used to describe a single encounter between breeding individuals during a breeding season. The decisions in the mating tactics stage are independent of the parental stage, but the total fitness increment gained depends on the parental stage. During the mating stage males can mate exclusively, with a single female, or inclusively, with multiple females. All males provide the same amount of direct benefits to females, which will either be used by one female or shared by many. Female strategies in this stage are: produce an amount of young conditioned upon the males strategy or produce a constant amount of young regardless of male strategy. In the parental stage both males and females can either care for or desert the young. An Evolutionary Stable Set exists consisting of conditional female reproductive output, exclusive male breeding during the mating stage and biparental care. Thus, under conditions of male provisioning and conditional female investment we should expect monogamous mating and biparental care to develop.

2. **EDGE EFFECTS ON THE NESTING SUCCESS OF REDWOOD FOREST BIRDS**. *JENNY KRANZ ALLEN, 18110 West Henry Miller Avenue, Los Banos, CA; T. LUKE GEORGE, Wildlife Department, Humboldt State University, Arcata, CA.

Higher predation and parasitism rates of nests along forest edges have been suggested as a possible cause for declines of Neotropical migrant birds in the midwestern United States. Logging, conversion to agriculture, and urbanization have led to fragmentation of many western forests; however, few studies have examined the effects of these activities on the nesting success of birds in these areas. We examined nesting success of Swainson's Thrushes and Winter Wrens along urban edges and interior (>100 m from edge) sites in mature and old-growth redwood forests in northwestern California. We used nest monitoring, territory mapping, and the Vickery index to document their reproductive status. The results are very different for these two species. Swainson's Thrushes who nested near edges had a Mayfield estimate of only 19%, versus 56% for interior birds. Edge and interior Mayfield estimates for Winter Wrens were not significantly different, with an overall success rate of 65%. Using Cox's Proportional Hazards Regression, we confirmed the Mayfield analysis results, in that increases in urban edge may have negative effects for Swainson's Thrushes. (A3 - Conservation: 4/28 - 3:45)

3. **TIMING OF NESTING OF ROSEATE SPOONBILLS IN NORTHEASTERN FLORIDA BAY COMPARED TO WATER MANAGEMENT PRACTICES**. *ELSA M. ALVEAR, Department of Biological Sciences, Florida Atlantic University, Boca Raton, Florida. JOHN C. OGDEN, South Florida Water Management District, Miami, Florida. SHEILA A. MAHONEY, Department of Biological Sciences, Florida Atlantic University, Boca Raton, Florida. ANNABELLE C. MCKIE, Department of Biological Sciences, Florida Atlantic University, Boca Raton, Florida.

Direct inflow of fresh surface water from the mainland Everglades to estuarine Florida Bay has changed in volume and timing over the past century, due to canal construction and flood control. The modified hydrology has changed plant and animal communities within Florida Bay, prompting proposals for a more natural system of water delivery and highlighting the need for historical information on Florida Bay biota and their responses to changing water management practices. Wading bird colonies are used as indicators of hydrological and ecological conditions in the freshwater Everglades basin because colony size, location, and timing of nesting respond quickly to local and regional hydrological changes; however, trends for wading bird colonies in Florida Bay have not been fully examined. Three wading bird species are considered "specialists" of the Florida Bay estuarine system: Reddish Egret (*Egretta rufescens*), Great White Heron (*Ardea herodias occidentalis*), and Roseate Spoonbill (*Ajaia ajaja*). Long-term population trends have been examined for these species, but timing of colony nesting has not. Of these three, the longest relatively continuous record of colony information (dating to the 1930s) exists for the Roseate Spoonbill, found in National Audubon Society warden reports, National Park Service documents, researcher boat logs, and other sources. We examined these documents and calculated initiation dates for spoonbill colonies in northeastern Florida Bay by comparing observer comments on colony behavior and nest contents with known breeding biology of the species. These dates were arranged into categories based on known hydrological regimes. We performed analyses for 1) significant differences in mean starting dates between categories, and 2) variance in starting dates within categories, to determine if timing of nesting of Roseate Spoonbill colonies could serve as an appropriate indicator of ecological conditions in northeastern Florida Bay.

4. **A NEW PARADIGM FOR MONITORING THE ABUNDANCE OF NORTHERN-NESTING BIRDS.** *JONATHAN BART, Snake River Field Station, USGS, Boise, ID; BRAD ANDRES, US Fish and Wildlife Service, Anchorage, AK; KENT WOHL, US Fish and Wildlife Service, Anchorage, AK.

New National Assessment and Monitoring programs for shorebirds and landbirds call for estimating population size, and trend in size, for all landbirds and shorebirds that regularly breed in the US and Canada. Many species occurring in temperate latitudes are well-covered by the Breeding Bird Survey, but species that nest in boreal and arctic regions are not well-covered at present. The paradigm being suggested in the new Assessment and Monitoring programs contains three parts: (1) an initial, extensive 3-5 year survey of the breeding grounds to estimate population size, prepare abundance maps, and establish a benchmark for future work, (2) subsequent monitoring at migration concentration points to obtain indications of trends, (3) occasional further surveys on the breeding grounds, as needed to verify disturbing trends detected at migration stations. Implementation of this approach will require cost-effective methods for surveying birds in remote northern regions. This paper will illustrate one approach that we are using to estimate population size and prepare abundance maps of shorebirds on Alaska's North Slope. (C4 - Habitat Relationships and Conservation: 4/29 - 3:45)

5. **DOES TROPHIC STRUCTURE MORPHOLOGY OF THE STELLER'S JAY (*Cyanocitta stelleri*) VARY IN RELATION TO HABITAT TYPE?** *KIRSTIE M. BAY, Department of Biology, University of Colorado at Denver, P.O. Box 173364, Denver, CO; DIANA F. TOMBACK, Department of Biology, University of Colorado at Denver, P.O. Box 173364, Denver, CO.

We conducted an ecomorphological analysis of trophic structure variation in the Steller's Jay (*Cyanocitta stelleri*), a western species exhibiting considerable geographic variation across its range extending from Alaska to Nicaragua. We asked whether trophic structures and other morphology vary with habitat, even within a limited geographic region. Trophic structure differences may indicate local differences in foraging modes and principal food types. Bill length, depth, and width; tarsus length and width; wing cord; and tail length were measured for study skins of 158 adult Steller's Jays obtained from museum research collections. Jays were analyzed from four habitat types: two from Colorado and New Mexico ponderosa pine (*Pinus ponderosa*) forest and pinyon-juniper (*P. edulis - Sabena spp.*) woodland; and two from California ponderosa pine (*P. ponderosa*) forest and a mosaic of coastal redwood (*Sequoia sempervirens*), Monterey pine (*P. radiata*), coast live oak (*Quercus agrifolia*), and chaparral. Multivariate analysis of variance (MANOVA) on all jays (males and females) suggested a significant difference in morphological characteristics among all habitats except Colorado pinyon-juniper woodland and Colorado ponderosa pine ($F_{pj,COpp}$= 1.766, $p<0.10$; $F_{pj,coast}$ = 23.407, $p<0.001$; $F_{pj,CApp}$ = 4.809, $p<0.001$; $F_{COpp,coast}$ = 30.434, $p<0.001$; $F_{COpp,CApp}$= 8.324, $p<0.001$; $F_{coast,CApp}$= 8.640, $p<0.001$; df 7,146). Similarly, MANOVA on female jays suggested a significant difference in morphological characteristics among all habitats except Colorado pinyon-juniper woodland and Colorado ponderosa pine ($F_{pj,COpp}$ = 1.372, $p<0.25$; $F_{pj,coast}$ = 14.501, $p<0.001$; $F_{pj,CApp}$ = 2.937, $p<0.001$; $F_{COpp,coast}$ = 23.955, $p<0.001$; $F_{COpp,CApp}$ = 5.140, $p<0.001$; $F_{coast,CApp}$ = 5.670, $p<0.001$; df 7,65). MANOVA on males suggested a significant difference in morphological characteristics among all habitats ($F_{pj,COpp}$ = 3.088, $p<0.005$; $F_{pj,coast}$ = 12.747, $p<0.001$; $F_{pj,CApp}$ = 3.978, $p<0.001$; $F_{COpp,coast}$ = 12.775, $p<0.001$; $F_{COpp,CApp}$ = 6.049, $p<0.001$; $F_{coast,CApp}$ = 4.580, $p<0.001$; df 7,72). These analyses show a strong correlation between morphological features and habitat in male jays and a weaker correlation in females. These findings suggest that populations adapt to local environments, and adaptations are more closely correlated with habitat in male jays than in female jays. (C1 - Foraging Behavior and Ecology: 4/29 - 9:45)

6. **TIMING OF BREEDING RANGE OCCUPANCY AMONG HIGH LATITUDE PASSERINE MIGRANTS**. *ANNA-MARIE BENSON, Alaska Bird Observatory, P.O. Box 80505, Fairbanks AK, 99708; KEVIN WINKER, University of Alaska Museum, 907 Yukon Drive, Fairbanks AK, 99775.

The brief subarctic summer limits the time available for birds to complete their reproductive activities, yet the temporal requirements of high-latitude passerine migrants are not well understood. Our analyses examined the timing of spring and autumn migration among 18 passerine species to obtain indirect estimates of the time they occupy their breeding ranges in northwestern North America. From 1992 to 1998, the Alaska Bird Observatory (64?50' N, 147?50' W) banded 31,698 individuals during the most intensive standardized mist-netting study ever conducted in subarctic North America. Among the migrants examined, the estimated number of days that species were present in interior Alaska ranged from 48 days for adult Alder Flycatchers (*Empidonax alnorum*) to 129 days for American Robins (*Turdus migratorius*). Adults departed significantly later in autumn than immatures in 7 of 18 species we examined and significantly earlier than immatures in only one species, the Alder Flycatcher. Breeding range occupancy of Nearctic-Neotropic migrants occurs in this region within the range of average frost-free temperatures in Fairbanks, Alaska, and is significantly shorter in duration than among Nearctic-Nearctic ("short-distance") migrants at this latitude. (A1 - Migration: 4/28 - 11:00)

7. **SONGBIRD ABUNDANCE ON OPEN SPACE GRASSLANDS IN AN URBANIZED LANDSCAPE.** *CARL E. BOCK, Department of Environmental, Population, and Organismic Biology, University of Colorado, Boulder, CO; SANDRA L. HAIRE, U. S. Geological Survey, Midcontinent Ecological Science Center, Fort Collins, CO.

We conducted point counts of songbirds on 66 Boulder, Colorado, open space grassland plots for three summers, and compared results to landscape and habitat attributes of the plots. Five of the seven most abundant grassland nesting species were scarce on plots embedded in landscapes that were more than 10% urbanized (Horned Lark, Savannah Sparrow, Lark Sparrow, Vesper Sparrow, Grasshopper Sparrow), while two (Western Meadowlark and Red-winged Blackbird) were common throughout but were still most abundant on the least urbanized plots. Four other species visited open space grasslands more frequently when they were adjacent to suburban developments (European Starling, House Finch, Common Grackle, and House Sparrow). Two species, Mourning Dove and Black-billed Magpie, exhibited a bimodal abundance pattern suggesting the existence of separate urban and rural populations. Results indicate that most grassland nesting birds avoided open spaces embedded in urban landscapes, regardless of grassland habitat type or condition, and suggest a critical urban landscape threshold of about 10%. Possible causes include the presence of competing urban species and, more likely, predation by urban commensals such as raccoons, skunks, and house cats. (A3 - Conservation: 4/28 - 4:45)

8. ***FORAGING ECOLOGY AND ROLE OF PINE SEEDS IN THE DIET OF STELLER 92S JAY.** *SARA M. BREINDEL, Department of Biology, University of Colorado at Denver, Denver, CO; DIANA F. TOMBACK, Department of Biology, University of Colorado at Denver, Denver, CO. We examined the year round foraging patterns of Steller's Jays (*Cyanocitta stelleri*), focusing on their choice of foraging substrate and the importance of pine seeds in their diet. Steller's Jays may play a role dispersing pine seeds and, if so, must show a preference for pine seeds when available. To determine foraging patterns, an activity budget was constructed year round from July 1998 to December 1999 at three study sites along the Front Range of the Colorado Rocky Mountains. When pine seeds were available, seed foraging rates in seconds per seed were recorded, as well as cone ripening phenology and ground density of wind-blown seeds. Data were analyzed for patterns in foraging behavior and conifer seed use. During this study, no one foraging substrate was used to the exclusion of all others. However, there appear to be seasonal changes in substrate use and a definite preference for ponderosa pine seeds (*Pinus ponderosa*), when available. Trees were the predominant foraging substrate in winter and summer. During spring and falls when pine seeds were not available, general ground foraging predominated. When ponderosa pine seeds were available, ground foraging predominated in September, with increasing seed foraging until seed foraging predominated in November. Jays were observed to carry seeds in their throats and fly off, presumably caching them. By December, the jays returned to tree foraging. The amount of time foraging for pine seeds corresponded to changes in ground seed density and to changes in seed foraging rates. From this, it appears the jays are efficient opportunists that preferentially forage on and potentially disperse pine seeds when available. (C1 - Foraging Behavior and Ecology: 4/29 - 9:15)

9. **MICROHABITAT SELECTION BY MIKADO PHEASANTS**. CARA LIN BRIDGMAN, Department of Ecology and Evolutionary Biology, University of Tennessee, Knoxville, TN 37996-1660 (caralin@utk.edu).
The endemic Mikado Pheasant, *Syrmaticus mikado*, is found in a variety of Taiwan's habitats over 1600 m in elevation. Here, I test the hypotheses that there is microhabitat selection by the Mikado pheasant and the similarity of preferred areas to regenerating or primary forest. Habitat analysis of 215 locations inside Yushan National Park were surveyed to test for differences in three categories: study site (logged and unlogged), pheasant activity (hot spots and cold spots) and trail effects (on trail or 15 m from the trail). Data were collected for 17 habitat variables and tested for differences and interactions using a multivariate analysis of variance (Proc GLM: MANOVA), with a univariate analysis (t-test) to examine the effect of each variable on each category. All three categories showed significant differences. Univariate analysis suggests that hot spots of pheasant activity significantly differed from cold spots by having lower percent leaf litter, more herb coverage, more herb species, and an absence of lianas and fruits, nuts, and insects. Furthermore, most Mikado pheasants were encountered while feeding, suggesting that this analyses describes preferred feeding habitat. Herb coverage and species diversity may be important indicators of food availability. As the Mikado pheasant lives at an elevation in Taiwan that is naturally disturbed by landslides, a certain tolerance for disturbance would be considered adaptive. Regardless, characteristics of hot spots are more similar to conditions of the unlogged study site.

10. ***SUBSPECIFIC DIFFERENTIATION AND GENETIC POPULATION STRUCTURE OF SONG SPARROWS (MELOSPIZA MELODIA) IN SAN FRANCISCO BAY**. YVONNE L. CHAN and PETER ARCESE, Center for Applied Conservation Biology, University of British Columbia, BC Canada

The song sparrow (*Melospiza melodia*) is one of the most polytypic songbirds in North America with 34 subspecies described. This differentiation makes the song sparrow a model organism for understanding the evolutionary processes that result in geographic variation in morphology. Understanding the evolution of geographic variation in morphology will provide insight into the process of genetic differentiation and, ultimately, speciation. Despite intensive genetic studies on song sparrows using mitochondrial DNA (mtDNA), no clear patterns between measured variation in haplotypes and observed morphological differences have emerged. However, hypervariable tandem repeat nuclear loci, such as microsatellites, may provide a better tool for studying differentiation in song sparrows than mtDNA due to high mutation rates and large numbers of alleles. I used 9 microsatellite loci to test for the presence of microevolutionary processes that may have caused geographic variation in song sparrow morphology and subspecific differentiation in the San Francisco Bay region where there are four morphologically distinct year-round resident song sparrow subspecies. An examination of the genetic differentiation of the San Francisco Bay tidal marsh subspecies is particularly important due to large scale, anthropogenic changes which have removed 85% of the original tidal marsh habitat in the San Francisco Bay region. These changes have raised concerns about the taxonomic status of the tidal marsh song sparrows and about the impacts of further habitat loss and fragmentation on genetic population structure.

11. **NEST SITE SELECTION AND NEST SUCCESS IN A SONG SPARROW POPULATION BREEDING IN TWO HABITATS**. MARY K. CHASE, Department of Biology, University of California, Riverside, CA.

If nest site selection by birds is influenced by natural selection acting via nest predation, we might expect that preferred nest sites would also be the most successful. I attempted to test the hypothesis that nest microhabitat preference is currently adaptive in a Song Sparrow (*Melospiza melodia gouldii*) population by determining whether nests placed in preferred microhabitat were more successful than other nests. Nest site choices and their consequences were studied in two sites: one in grazed coastal scrub and grassland habitat, and one in ungrazed coastal scrub. In both sites, nest patch habitat differed significantly in structure and plant species composition from habitat available within territories. However, the suite of habitat characteristics associated with nest site choice was unrelated to nest success in multivariate analyses. Also, few individual characteristics of nest sites were related to nest success. Only one variable (abundance of coyote bush) was associated with both nest site selection and nest success, and only in the grazed site. In contrast, coyote bush was unrelated to nest site choice and negatively related to nest success in the ungrazed site. In the ungrazed site, nests built in larger discrete patches of vegetation were more successful. Although the sites differed greatly in the amount of preferred nest microhabitat available, there was no difference between the sites in the overall rate of nest success (28-32 %). I speculate that high levels of predation from a diverse community of nest predators may weaken natural selection on nest site preferences in this population, or at least obscure the expected relationship between nest site choice and nest success. (B2 - Nest Selection: 4/28 - 2:15)

12. ***FAT RESERVES IN WINTERING BOHEMIAN WAXWINGS**. *JOHN P. DeLONG, Department of Biology, Utah State University, Logan, UT; J. BRIAN BURNS, Department of Biology, Utah State University, Logan, UT; JAMES A. GESSAMAN, Department of Biology, Utah State University, 5305 University Blvd, Logan, Utah 84322.

We studied a flock of Bohemian Waxwings (*Bombycilla garrulus*) wintering in northern Utah to test predictions of the optimal body mass hypothesis. We believed that age and sex groups in this population experienced similar levels of starvation and predation risk because they lacked sexual dimorphism and appeared to lack dominance interactions. Accordingly, we found no difference in total body fat or percent body fat between age and sex classes ,a result that supports the optimal body mass hypothesis. However, we did not have data to demonstrate the absence of starvation and predation risk gradients between age and sex classes. Therefore, it is also possible that the patterns of fat storage we observed resulted from subordinates (juveniles and females) experiencing a greater risk of both starvation and predation. We graphically illustrate how these two different risk scenarios can produce the same pattern of age- or sex-specific fat storage. We show that conflicting patterns of fat storage reported in the literature can all occur within the context of the optimal body mass theory given variation in the relative degree of starvation and predation risk. (B3 - Physiology, Morphology, and Disease: 4/28 - 4:30)

13. **EGG RECOGNITION BEHAVIOR DIFFERENCES BETWEEN CALIFORNIA AND SPOTTED TOWHEES.** *KEVIN ELLISON, Department of Zoology, University of Manitoba, Winnipeg, MB, and STEPHEN I. ROTHSTEIN, Department of EEMB, University of California, Santa Barbara, CA.

Through recent range expansions, the brood-parasitic Brown-headed Cowbird (*Molothrus ater*) has come into contact with host populations that have not coevolved with brood parasites. In southern California, where breeding cowbirds arrived within the past 100 years, we presented nonmimetic blue eggs to two known cowbird hosts to determine whether they can recognize and eject foreign eggs. California Towhees (*Pipilo crissalis*) accepted all 14 eggs placed in their nests. In contrast, Spotted Towhees (*P. maculatus*) ejected the eggs in 55% of tests (N=11). Because Spotted Towhees eject nonmimetic eggs but not cowbird eggs, we suggest that the similarity of cowbird and Spotted Towhee eggs enhances acceptance of cowbird eggs. Our results suggest that either historic parasitism on the Spotted Towhee or an ancestral species of towhee has selected for the current level of egg discrimination.

14. **IDENTIFICATION OF BUFFLEHEAD MOULTING SITES IN INTERIOR BRITISH COLUMBIA.** *MATTHEW R. EVANS, Center for Wildlife Ecology, Simon Fraser University, Burnaby, BC
ANDRE BREAULT, Canadian Wildlife Service, Delta BC

The breeding population of Bufflehead (*Bucephala albeola*) extends across North America's boreal forest and aspen parkland. Ninety percent of the population is believed to breed from Manitoba westward. No published information is available for molting areas. Banding efforts in British Columbia through 1998 and 1999 have resulted in the capture of over 400 molting Bufflehead. Ground counts conducted in August 1999 indicated the presence of over 1000 molting Buffleheads on ~30 wetlands near Riske Creek, BC Based on tarsus measurements, females accounted for 57% of the molting Buffleheads. This banding data establishes that females aggregate during molt and that males and females molt in the same general area. Five female and 3 male Buffleheads banded during molt in 1998 were recaptured during molt in 1999, indicating male and female philopatry to molting grounds. The breeding population of Bufflehead in the Riske Creek area has been tracked since 1997. Since then, over 100 Buffleheads breeding in the area have been banded and equipped with nasal discs. The 1999 banding of molting birds and associated surveys resulted in no recaptures or sightings of birds previously banded as breeding adults in Riske Creek. This indicates that Buffleheads breeding in Riske Creek depart from the area before molt while new birds arrive from elsewhere to initiate molt in the area. One hatch-year (local) male banded in 1998 was recaptured (in molt) in 1999, suggesting that unpaired males (second-year) might molt in their natal area on their first year. Data on distribution and abundance of molting waterfowl in BC will be used to estimate molting population size, habitat characteristics of molting lakes and important molting sites in the province.

15. **NATURAL CAVITY USE BY BARROW'S GOLDENEYE AND BUFFLEHEAD IN BRITISH COLUMBIA, AND A COMPARISON TO NEST BOX USAGE.** *MATTHEW R. EVANS, DAVID B. LANK, FRED COOKE, Center for Wildlife Ecology, Simon Fraser University, Burnaby, BC W. SEAN BOYD, Canadian Wildlife Service, Delta BC

Both Barrow's Goldeneye (*Bucephala islandica*) and Bufflehead (*B. albeole*) are secondary cavity nesters and rely heavily on nest sites created by primary cavity nesters such as Pileated Woodpeckers (*Dryocopus pileatus*) and Northern Flickers (*Colaptes auratus*), respectively. However, studies of natural cavity selection and success by these birds are lacking. Prior studies have predominantly made use of artificial nest boxes. This study examines the biophysical characteristics of cavity nest sites (tree species, decay class, dbh, distance from water, and distance from forest edge) and compares the nesting demographics of cavities to those of nest boxes. In 1997 and 1998 30 Barrow's Goldeneye and 80 Bufflehead natural cavities were examined. For both species nest sites were predominantly in aspen (74% and 85%, respectively) followed by Douglas Fir (22% and 9%, respectively). Barrow's Goldeneye cavities were typically 91.69m from water and 54.52m from forest edge. Bufflehead were found nesting 44.68m from water and 2.89m from forest edge. Nesting success for Barrow's Goldeneye cavities was 86% in 1997 and 78% in 1998. This is compared to nest box nesting success of 52% and 48%, respectively. Bufflehead cavity nesting success was 88% in 1997 and 84% in 1998 and nest box success was 83% and 90%, respectively. Sources of nest failure and patterns of nest site philopatry for both cavities and nest boxes are also presented.

16. ***DAY-NIGHT DIFFERENCES IN HABITAT USE AND BEHAVIOUR BY DUNLIN WINTERING IN THE FRASER RIVER DELTA, CANADA.** LESLEY J. EVANS-OGDEN, Wildlife Ecology Research Chair, Department of Biology, Simon Fraser University, Burnaby, BC, Canada.

The Fraser River Delta in southern British Columbia represents the only major over-wintering habitat in Canada for shorebirds. Adjacent to the vast food-rich area of intertidal mudflats is an extensive area of farmland also used by feeding and roosting shorebirds, particularly during high tides. In light of pressure on this habitat due to land-use changes, this research aims to prioritize key habitat for shorebirds within the agricultural mosaic, and identify the major environmental and biological correlates influencing habitat choices. Surveys of fields in 1998-99 conducted varying distances from the coastline have elucidated a strong negative correlation ($r = -0.80$) between distance from shore and numbers of Dunlin (*Calidris alpina pacifica*) found, and fields within one kilometer of the shoreline appear to represent the most critical habitat of this agricultural zone. Systematic surveys have also determined distinct day-night differences in the use of farm fields. During the day, Dunlin typically use a smaller number of field types ($n=6$) and usually occur in dense flocks of up to several hundred individuals per field (mean = 30.9). At night, Dunlin use a larger array of field types ($n=10$), and are widely dispersed at lower density (mean = 4.8 per field). I hypothesize that this contrast in behavior is driven by the differential risk of diurnal versus nocturnal predation. This day-night difference in habitat use has obvious conservation implications, and underlines the importance of investigating species over a 24 hour day, particularly in coastal species that may be more strongly influenced by tides than by circadian regimes. (A3 - Conservation: 4/28 - 3:30)

17. **DISEASE EMERGENCE IN BIRDS: CHALLENGES FOR THE TWENTY-FIRST CENTURY.** *MILTON FRIEND, United States Geological Survey, Biological Resources Division, Madison, WI; ROBERT G. MCLEAN, USGS, Biological Resources Division, Madison, WI; F. JOSHUA DEIN, USGS, Biological Resources Division, Madison, WI

Disease emergence in free-ranging avian populations has been prominent during the later part of the 20th Century, especially for infectious diseases. In addition, considerable geographic expansion has been seen for avian botulism, a noninfectious environmental disease that is probably the leading cause of death from disease among waterbirds. The magnitude of mortality from individual disease events often reaches thousands to tens of thousands of birds. The loss of an estimated 1.5 million waterbirds from avian botulism from two consecutive events within a short-time period during 1998 is a striking example of the magnitude of losses that can occur. Failure to proactively address disease as a component of avian conservation makes a mockery of conservation efforts because of the combination of factors interacting to impact the well being of our avifauna. These factors are: (1) the magnitude of losses occurring; (2) the diversity of species experiencing major disease problems; (3) the diminished resiliency of species to sustain high losses from disease; (4) the impact of continual human population growth on landscape change; and (5) changes in human behavior toward free-ranging avifauna. Disease emergence in birds parallels that occurring for humans because birds are subject to many of the same factors involved in the resurgence of infectious disease in human populations. The recent introduction of West Nile virus into the Western Hemisphere demonstrates the rapidity of global movement of diseases and the significant mortality in crows from this virus in the northeastern states shows the impact a new disease agent can have on native bird species. Other examples of disease occurrence due to these factors and the resulting losses of birds are provided to illustrate these associations. Recommendations are provided that focus on actions needed to minimize these types of losses. (B3 - Physiology, Morphology, and Disease: 4/28 - 4:45)

18. **SPRING ARRIVAL DATES AND PHYSICAL CONDITION IN A DECLINING POPULATION OF WARBLING VIREOS**. THOMAS GARDALI, GRANT BALLARD, NADAV NUR, AND GEOFFREY R. GEUPEL, Point Reyes Bird Observatory, Stinson Beach, CA.

Warbling Vireos (*Vireo gilvus swainsonii*) have been declining in California and recent evidence suggests that low reproductive success may be primarily responsible. The specific factors causing poor reproductive success are not known. Spring arrival date and physical condition have been shown to be determinants of reproductive success in other migratory species. Earlier arriving individuals may have more opportunity to replace lost clutches or attempt second broods, and may have access to the best breeding sites and mates. Moreover, parental condition has been shown to influence clutch size and laying date in other passerines. To test whether reproductive success of Warbling Vireos was influenced by these factors we examined trends and relationships among spring arrival dates, physical condition, and productivity using 19 years of standardized mist-net data in coastal California. Temporal trends in mean arrival date of returning breeders, first five spring captures, and all individuals captured from March through May show that vireos have arrived on their breeding grounds later over the course of the study. Additionally, vireos that arrived later were in poorer physical condition than early arrivals. Productivity, as indexed by capture rates of hatch-year birds, was negatively correlated with spring arrival date of adults. Arrival time and physical condition probably acted synergistically with factors such as increasing predator densities to account for low reproductive success and the associated decline of Warbling Vireos in California. The factors responsible for variation in arrival schedules are not well known but may be influenced by winter and migratory stopover habitat quality. Since arrival time and condition appear to influence productivity, management activities whose goal it is to reverse population declines should focus on breeding, migratory, and wintering ecology and recognize the potential for relationships among them.

19. **CACHE RECOVERY ACCURACY BY THREE SPECIES OF SEED-CACHING CORVIDS IN AN OPEN FIELD**. TOM GREENE, ARLA G. HILE,* RUSSELL P. BALDA, Department of Biological Sciences, Northern Arizona University, Flagstaff, AZ.

This study compares the cache recovery accuracy of three species of seed-caching corvids. Two of these species, Clark's Nutcracker (*Nucifraga columbiana*) and Pinyon Jay are highly dependent on cached food for winter survival and early breeding. The third species, Western Scrub Jay (*Aphelocoma californica*) is less dependent on cached food and does not breed early. We tested the hypothesis that more dependent species should demonstrate higher levels of spatial memory than less dependent species. This is the first study using an open field where the birds have total control of the cache sites selected. The birds cached and recovered from a large sand-filled tub placed in an outdoor aviary. We recorded all recovery probes with a video camera and displayed these on a monitor where a transparent film was superimposed over each cache site. On the film an array of concentric circles was drawn at 5 cm radii from the cache. We measured the distances from the actual cache site for all probes. Western Scrub Jays made many more probes per cache than the other two species. There was a significant interaction effect between species and distance probed ($P = 0.0035$). Pinyon Jays concentrated more than 50% of their probes less than 20 cm from the actual cache site and Western Scrub Jays made over 60% of their probes more than 20 cm from the cache site. Western Scrub Jays also made the fewest probes directly at the cache site. These data support the dependency hypothesis and provide the fourth set of data, using different tests and experimental procedures to do so. These results also help rule out the possibility that Western Scrub Jays performed relatively poorly in previous indoor tests because these tests lacked adequate natural cues. (C1 - Foraging Behavior and Ecology: 4/29 - 9:00)

20. **MIGRATION OF LANDBIRDS THROUGH DESERT RIPARIAN HABITATS OF THE SALTON SEA AND ITS ENVIRONS**. *SUSAN L. GUERS, MAUREEN E. FLANNERY, GEOFFREY R. GEUPEL, and NADAV NUR; Point Reyes Bird Observatory, Stinson Beach, CA.

Waterbird and shorebird use of the Salton Sea has been studied in detail, however there is limited and mostly anecdotal information on landbird migration through the area. In 1999, the Point Reyes Bird Observatory systematically surveyed landbirds at the Salton Sea to determine the use of its desert riparian habitats as migratory stopover sites. Using constant-effort mist-netting, point count surveys, and area search surveys, we assessed the diversity and abundance of birds in these habitats. During spring we surveyed four riparian sites along the north, south and eastern shores of the Sea. In fall we surveyed five riparian sites and one residential site all on the eastern shore of the Sea. Using constant-effort mist-netting, we caught a total of 1542 individuals of 47 species at overall rates of 137.1 and 345.3 birds per 100 net hours in April and May, respectively. Less than 1% of the birds we caught were hatch year birds. During fall, we caught a total of 892 individuals of 49 species at overall rates of 73.4 and 64.6 birds per 100 net hours in September and October, respectively. Hatch year birds accounted for 45% of all total captures. We evaluated the use of the area during migration by comparing it to other banding and survey locations throughout the West. During spring, we caught Wilson's Warblers at an overall rate of 82.8 birds per 100 net hours, which accounted for 39% of all captures. More Wilson's warblers were caught at the Salton Sea during spring migration than at any other mist-netting site in California. The abundance of neotropical migrants recorded during spring and fall, provides evidence that the area is used extensively by migrating passerines, including 11 species of statewide concern in riparian habitats. The high use of the Salton Sea and its environs by landbirds during migration suggests the need for effective management and restoration of desert riparian habitats.

21. **IMMUNE RESPONSES OF EASTERN BLUEBIRD (*Sialia sialis*) NESTLINGS TO PARASITISM BY BLOWFLY (*Protocalliphora sialia*) LARVAE**. KRISTINA HANNAM, University of Nevada, Reno, NV.

Avian nestling host-parasite relationships have been the subject of much recent research, but the examination of nestling immune defenses is just beginning. I experimentally tested whether nestling eastern bluebirds parasitized by blowfly larvae raise an immune response measurable through differential leukocyte counts. I predicted that parasitism would result in higher total leukocyte counts, and that avian eosinophils, like mammalian eosinophils, would respond strongly to parasites. Nests were randomly assigned to have natural parasite levels or to have parasites removed. I made blood smears on nestling day 14, and scanned them under oil-immersion for leukocytes. All leukocytes from 100 fields on each slide were counted and divided into cell type categories. There was no significant treatment effect on total leukocyte counts, but parasite intensity significantly affected all cell types except monomorphonuclear cells and lymphocytes. Nestling condition and lymphocyte count were significantly positively correlated. Hemoglobin concentration, a measure of the strength of parasite effects, was significantly negatively related to granulocyte and eosinophil counts. These results demonstrate that nestling hosts respond immunologically to attacks from blowfly parasites, and that avian eosinophils respond as mammalian eosinophils do to parasitism. (B3 - Physiology, Morphology, and Disease: 4/28 - 4:15)

22. **DO HIGHLY SALINE ENVIRONMENTS IMPOSE A PHYSIOLOGICAL STRESS ON YOUNG AMERICAN AVOCETS (*Recurvirostra americana*)?** KRISTINA HANNAM and LEWIS ORING Dept. of Environmental & Resource Sciences, University of Nevada, Reno, NV.

Many shorebird populations use Great Basin wetland habitats for breeding and migration. These Great Basin wetlands can vary in salt concentrations both within and between years. High salt concentrations may pose a water-balance problem for the birds, and chicks in particular may be vulnerable to stress imposed by these highly saline environments. In the laboratory we examined the effects of various salinity regimes on behavioral and developmental measures of stress in the chicks of a common Great Basin breeder, the American Avocet. In 1999 we raised young avocets at the University of Nevada's shorebird facility under a range of salinity conditions that reflect those found in Great Basin wetlands. Eggs were collected in the wild, and chicks were raised until the age of 3 days at one of four salinities: freshwater, brackish, saline and hypersaline. Chicks reared under hypersaline conditions (i.e. typical of Mono Lake or Lake Abert) failed to gain weight, resulting in significantly lower body condition by day 3. In addition, the same chicks exhibited behaviors typical of stressed animals. Hypersaline-raised chicks spent significantly more time running around the ponds, and significantly less time feeding. Hypersaline-raised chicks also tended to spend more time vocalizing and head-shaking, although these differences were not statistically significant. These observations suggest that chicks raised in high salinity environments in the wild may be physiologically stressed because of a water-balance problem which could lead to decreased future survival.

23. ***A POTENTIAL 'PASSWORD' FOR SPECIES RECOGNITION IN A BROOD PARASITIC BIRD, THE BROWN-HEADED COWBIRD**. MARK E. HAUBER, Field of Neurobiology and Behavior, Cornell University, Ithaca, NY 14853

Obligate brood parasitic birds are reared by foster parents and are typically rarely exposed to conspecific stimuli during early development. Nonetheless, parasites are able to discriminate between conspecifics and heterospecifics at sexual maturity and, in some species, as juveniles. I studied the development of species discrimination prior to sexual maturation in brood parasitic Brown-headed Cowbirds (*Molothrus ater*). I found that parasitic nestlings responded above chance levels to the 'chatter' vocalization of adult cowbirds but not to other conspecific songs and heterospecific controls. In addition, during playback experiments in the field juvenile cowbirds were more likely to approach the proximity of chatters than control playbacks. Finally, in the laboratory juvenile cowbirds that were hand-reared in acoustic isolation from adult conspecifics, had shorter latencies in approaching the playbacks of cowbird chatters than heterospecific control songs. These findings suggest that the species-specific cowbird chatter may be an initial cue -- a 'password' -- for conspecific recognition. (B1 - Song: 4/28 - 11:45)

24. **EFFECTS OF A GLOBAL CLIMATE CYCLE ON THE SURVIVAL AND FECUNDITYOF A NEOTROPICAL MIGRANT SONGBIRD**. RICHARD T. HOLMES and T. SCOTT SILLETT, Department of Biological Sciences, Dartmouth College, Hanover, NH.

Progress toward understanding factors, including climate change, that determine the abundances of migratory birds has been difficult, largely because these species spend the breeding and non-breeding seasons in diverse locations, often on different continents. For black-throated blue warblers (*Dendroica caerulescens*), demographic rates in both tropical winter quarters and north temperate breeding grounds varied with fluctuations in the El Niño Southern Oscillation. Adult survivorship, adult fecundity, and juvenile recruitment were lower than average in El Niño years and higher than average in La Niña years. These findings demonstrate that migratory birds are affected by shifts in global climate patterns, and illustrate the need to consider events throughout the annual cycle, both natural and human-related, that affect their abundances. (C2 - Population Ecology, Climate, and Season: 4/29 - 11:45)

25. ***EFFECTS OF URBANIZATION ON WINTERING BIRD SPECIES RICHNESS, DIVERSITY, AND DENSITY IN ORANGE COUNTY, CA**. DEBBIE J. HOUSE, Department of Biological Sciences, California State Polytechnic University, Pomona.

Wintering bird species richness, diversity, and density was compared among four urban sites in Orange County, CA, and between those urban sites and a study site in a coastal sage scrub habitat in the Santa Ana mountains of Orange County. The four urban sites varied with respect to the age of development, canopy development, and total vegetation volume. The older urban sites had greater canopy development and vegetation volume than the younger sites. Richness and diversity of wintering species at each urban site was significantly less than that found at the coastal sage scrub site. Winter species richness and diversity at the urban sites increased with increasing age of the development. Several wintering species present at the coastal sage scrub site were absent from the urban sites. The densities of two common wintering species, Yellow-rumped Warbler and White-crowned Sparrow, were significantly less at all urban sites than at the coastal sage scrub site. Ruby-crowned Kinglet densities were not significantly lower at the urban sites than at the coastal sage scrub site. Within the urban sites, the density of Ruby-crowned Kinglets increased with increasing vegetation volume. Concurrent studies by the author, as well as studies by other researchers, have demonstrated that urban areas support fewer breeding species than natural areas. The information I present here suggests that in addition to breeding species, wintering bird species are also affected by urban development. (A3 - Conservation: 4/28 - 4:00)

26. ***RELATIONSHIPS BETWEEN ARTHROPODS AND SONGBIRDS IN RIPARIAN AREAS DURING FALL MIGRATION**. SHERRY E. HUDSON, Department of Biological Sciences, University of Idaho, Moscow, ID.

Songbirds migrating across western North America depend on patches of riparian vegetation as rest areas that provide both food and cover. Russian olive (*Elaeagnus angustifolia*) is a non-native plant that has expanded along western riparian corridors, often displacing native plant species such as willow (*Sail* spp.) and cottonwood (*Populus* spp.). I compared vegetation characteristics, arthropod abundance, and songbird use between riparian areas dominated by willow and riparian areas with substantial encroachment by Russian olive. My goal was to evaluate the capture rate of songbirds and the number of species captured, with respect to the arthropod assemblage and vegetation structure of the riparian patch. At six study sites, three each in willow and Russian olive dominated riparian areas, I surveyed arthropods using sweep nets, beating trays, and sticky traps, and I surveyed songbirds using an array of mist nets at each site. Across all survey methods, I found a greater relative abundance of the arthropod orders Homoptera, Diptera, and Hymenoptera in willow than was observed in Russian olive dominated areas (MANOVA, $F = 21.88$, $p = 0.0001$; ANOVA, $p = 0.0001$, $p = 0.007$, and $p = 0.008$, respectively). Songbird survey results showed significantly greater numbers of neotropical migratory birds were captured in willow dominated sites, and significantly greater relative numbers of short distance migrants were captured in Russian olive sites (MANOVA, $F = 13.6$, $p = 0.0001$; ANOVA, $p = 0.0001$ and $p = 0.013$, respectively). A weak relationship ($p = 0.002$ to 0.047) between bird and arthropod variables suggests that birds in this area may have used stopover sites based on factors other than arthropod resources. These results imply Russian olive patches are useful to short-distance migrants during fall migration. However, land managers should consider limiting the spread of Russian olive into willow dominated riparian areas in the interest of conserving suitable habitat for neotropical migrant species during migration. (C2 - Population Ecology, Climate, and Season: 4/29 - 11:00)

27. **THE ROLE OF FORAGING WOODPECKERS IN THE DECAY OF PONDEROSA PINE**. KERRY L. HUGHES, Department of Fish and Wildlife Resources, University of Idaho, Moscow, ID; E.O. GARTON, Department of Fish and Wildlife Resources, University of Idaho, Moscow, ID; PATRICIA J. HEGLUND, Wildlife Biologist, Potlatch Corporation, Lewiston, ID; STEVE ZACK, Conservation Scientist, Wildlife Conservation Society, North America Program, Hillsboro, OR.

Woodpecker foraging and nesting activity is closely tied to tree decomposition stages, yet the distinct relationships between woodpecker use and the various phases of snag decay are poorly documented. It is clear, however that particular species are associated with recently killed trees, whereas others primarily use snags in more advanced stages of decay. In addition, snag decomposition may be accelerated by foraging woodpeckers, which puncture the bark, creating vectors for the colonization of sapwood decay fungi. In 1998 we initiated a study to examine the relationships between woodpecker foraging and snag decay processes in an Eastside pine forest community located in northeastern California. Our objectives were to (1) quantify relative foraging intensity across a chronosequence of known snag ages, and (2) determine the relationship between foraging intensity and sapwood decay. To address the first objective, a foraging intensity index based on the cumulative number of foraging excavations per square meter was used to compare foraging activity across known snag ages. Our results revealed no significant difference in cumulative foraging abundance between snags of different ages, suggesting that woodpecker foraging activity occurred primarily in the younger age classes. To address the second objective, we measured the relative degree of sapwood decay in ponderosa pine and compared it to levels of woodpecker foraging intensity in 144 ponderosa pine snags experimentally baited with bark beetle pheromone in 1996 and 1998. These results are synthesized into a conceptual model incorporating woodpecker foraging data, entomological data, and snag structural changes. This model is intended to provide further insight into the relationship between woodpecker habitat selection and successional patterns of decay organisms in ponderosa pine. (C1 - Foraging Behavior and Ecology: 4/29 - 10:15)

28. ***SONG VARIATION IN AN AVIAN RING SPECIES**. DARREN E. IRWIN, Department of Biology, University of California, San Diego, La Jolla, CA.

Divergence of mating signals can occur rapidly and be of prime importance in causing reproductive isolation and speciation. A ring species, in which two reproductively isolated taxa are connected by a chain of intergrading populations, provides a rare opportunity to use spatial variation to reconstruct the history of divergence. I use geographical variation in the song of a likely ring species, the Greenish Warbler (*Phylloscopus trochiloides*) to reconstruct the microevolutionary steps that occurred during divergence of a trait that is often important in speciation in birds. A west Siberian (*P. t. viridanus*) and an east Siberian (*P. t. plumbeitarsus*) form of the Greenish Warbler meet but do not interbreed in central Siberia; these forms are connected by a chain of interbreeding populations extending in a ring to the south around the treeless Tibetan Plateau. I show that 1) song structure differs greatly between the two Siberian forms, which share the same habitat; 2) song structure changes gradually around the ring; 3) singing behavior is relatively simple in the Himalayas but becomes increasingly complex to the north, both to the west and east of the Tibetan Plateau; and 4) song varies along independent axes of complexity in the western and eastern south-north clines. By comparing geographical variation in singing behavior and ecological variables, I distinguish among possible causes of song divergence, including selection based on the acoustic environment, stochastic effects of sexual selection, and selection for species recognition. I suggest that parallel south to north ecological gradients have caused a greater intensity of sexual selection on song in northern populations, and that the stochastic effects of sexual selection have led to divergence in song structure. (B1 - Song: 4/28 - 11:00)

29. **NEST SITE SELECTION AMONG GRASSLAND PASSERINES IN NORTHEASTERN MONTANA**. *STEPHANIE L. JONES, U.S.F.W.S., Region 6, Nongame Migratory Birds, Denver, CO; J. SCOTT DIENI, Redstart Consulting, Evergreen, CO; PAULA J. GOUSE, U.S.F.W.S., Bowdoin National Wildlife Refuge, Malta, MT.

We examined nest site habitat characteristics among six passerines that breed together in undisturbed mixed-grass prairie of northeastern Montana. Bird species included Sprague's Pipit (*Anthus spragueii*), Savannah Sparrow (*Passerculus sandwichensis*), Grasshopper Sparrow (*Ammodramus savannarum*), Baird's Sparrow (*A. bairdii*), Chestnut-collared Longspur (*Calcarius ornatus*), and Western Meadowlark (*Sturnella neglecta*). Habitat characteristics were measured at the nest and nest patch (5-m radius plot) for all nests discovered following intensive nest searching procedures during 1997 and 1998. Overall, 26 habitat variables were evaluated. Univariate and stepwise discriminant function analysis (DFA) were performed to describe and interpret habitat differences in nest site selection among the six bird species. The DFA derived five discriminant functions across six selected variables, with the first function accounting for 91% of the discriminating power of the model. The first function was strongly related to percent club moss cover, litter depth, and characteristics of vegetation structure at the nest and nest patch. Overall, the discriminant model correctly classified 61.3% of the cases, indicating considerable overlap among bird species. This was particularly true for Baird's and Savannah sparrows, and Western Meadowlarks, which occupied similar locations in discriminant space. These species tended to select nest sites characterized by greater vegetation density and structural diversity, particularly patches dominated by western wheatgrass (*Agropyron smithii*). Conversely, Chestnut-collared Longspurs occurred on the opposite end of the spectrum, favoring patches with greater club moss cover. We plan to continue this study; our goal is to measure changes in habitat characteristics within the study area over time, while concurrently examining the consistency of nest site selection patterns among these grassland passerines.

30. **THE BOTTERI SPARROW: AN AVIAN HABITAT SPECIALIST COLONIZING AN ALIEN GRASSLAND IN SOUTHEASTERN ARIZONA**. *ZACH F. JONES, CARL E. BOCK, Department of EPO Biology, University of Colorado, Boulder, CO.

The Botteri Sparrow (*Aimophila botteri*) is a tropical and subtropical tall-grass specialist, highly vulnerable to habitat alterations. It virtually disappeared from the American Southwest following drought and overgrazing in the 1890's. Today, Botteri Sparrows commonly occur in stands of sacaton grass (*Sporobolus wrightii*), a dominant native tall-grass that grows along floodplains in southern Arizona. They have also expanded into two additional and more abundant habitats: 1) upland mesas dominated by native short and mid-height grasses; and 2) areas dominated by an introduced African native, Boer lovegrass (*Eragrostis curvula* var. conferta). In 1999 we identified 71 Botteri Sparrow territories in 18 10-ha plots (6 plots per habitat). There were 34, 18, and 19 territories in sacaton, upland native, and Boer lovegrass plots, respectively. Young fledged per successful territory did not differ among the three habitat types. Territory density in sacaton was significantly greater than in either Boer lovegrass or native upland grasses. Average territory size was largest in Boer lovegrass and intermediate in sacaton. The percent of nests that fledged at least one young was 73% in Boer lovegrass, 56% in sacaton, and 55% in native upland grasses, with nearly all nest failures attributable to predation. Our results suggest that exotic Boer lovegrass is providing adequate nesting habitat for Botteri Sparrows and that territory density may not be reflective of habitat quality. Also implicit is that Botteri Sparrow territorial densities have yet to reach a saturation level in Boer lovegrass. Although more data are needed, results of our study suggest that exotic grasslands may be providing ecological and evolutionary opportunities for a species that otherwise has been and would continue to be narrowly distributed and uncommon. (C3 - Habitat Relationships and Conservation: 4/29 - 1:45)

31. **DENSITY DEPENDENT MASS GAIN BY WILSON'S WARBLERS DURING STOPOVER.** *JEFFREY F. KELLY, Rocky Mountain Research Station, Albuquerque NM; LINDA S. DELAY, New Mexico Natural Heritage Program, Albuquerque, NM; DEBORAH M. FINCH, Rocky Mountain Research Station, Albuquerque NM.

Potential for food-based competition at stopover sites is high because migration is energetically costly and stopover sites often have higher densities of birds than breeding or wintering regions. If food-based competition occurs at stopover sites: (1) migrants' rate of mass gain should be negatively related to the abundance of migrants; (2) migrants' rate of mass change should be positively associated with availability of food; and (3) availability of food (insects) should be positively related to the abundance of migrants. We tested these hypotheses with data on Wilson's Warblers and arthropods collected during migration through the Middle Rio Grande Valley in spring and fall 1996-1998. As predicted, percent mass change was negatively related to daily capture rates in both spring and fall. That is, rate of mass gain was lower when more potential competitors were present. Counter to our prediction, we found no relationship between percent mass change of Wilson's Warblers and mean insect abundance. Only abundance of Chalcidoidea (parasitic wasps) in the fall decreased significantly with increasing mass gain of Wilson's Warblers. Finally, evidence that migrant abundance was related to food availability was mixed. As predicted, abundance of insects in spring decreased with increased Wilson's Warbler abundance. This negative relationship was significant for all insect taxa except the Chalcidoidea . In the fall, however, there was generally a positive relationship between Wilson's Warbler abundance and numbers of insects present. In summary, our results suggest that mass gain by Wilson's Warblers migrating through the Middle Rio Grande Valley is density dependent; implying competition for food. Relationships among food availability, Wilson's Warbler abundance and mass gain, however, were inconsistent with this explanation.

32. **IMPACTS OF EL NINO/SOUTHERN OSCILLATION EVENTS ON WINTERING RAPTOR DENSITIES AND DISTRIBUTIONS AT THREE SCALES.** DANIEL H. KIM, Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, TX and Caesar Kleberg Wildlife Research Institute, Texas A&M University-Kingsville, Kingsville, TX, R. DOUGLAS SLACK, Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, TX, FELIPE CHAVEZ-RAMIREZ, Caesar Kleberg Wildlife Research Institute, Texas A&M University-Kingsville, Kingsville, TX and WWF-Mexico, Garcia Garza, NL Mexico

Factors affecting the numbers and distribution of non-breeding avian species are simple to identify in theory, but much more difficult to quantify in reality. We were interested in factors affecting the numbers of wintering raptors in south Texas. We observed large (up to 40 %) increases in raptor abundances from winter (January) 1998 to winter (January) 1999 along three roadside transects in south Texas. One large source of variation for south Texas was precipitation; 1998 was cooler and wetter than normal (El Niño), while 1999 was warmer and drier (La Niña). To test the hypothesis that the changes in numbers we observed were due the effects of El Niño/Southern Oscillation events, we used Christmas Bird Count (CBC) data and information from the National Oceanic and Atmospheric Administration's National Climate Data Center (NOAA, NCDC). We divided the central flyway into five moisture/temperature regions according to deviation from normal during El Niño and La Niña events. We then correlated differences in raptor abundance from 1975-1998 with magnitude of El Niño - La Niña events (1 - 7 with normal = 4). Seven out of 20 correlations were significant at $p < 0.10$. We also examined patterns of raptor densities in Texas and New Mexico, contrasting coastal densities to those found inland. Finally, we predict the January 2000 roadside data should reflect increased numbers of raptors in 1999. (C2 - Population Ecology, Climate, and Season: 4/29 - 11:15)

33. **BREEDING BIRDS AND UPPER MISSISSIPPI RIVER FLOODPLAIN FORESTS: ONE BIRD COMMUNITY, ONE HABITAT TYPE?** EILEEN M. KIRSCH, U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI

Surveys of breeding birds and their habitats were conducted in selected reaches of the Upper Mississippi River during 1994-1997. Survey points were randomly selected in forest habitat in Arc/Info using 1:15,000 scale GIS coverages. Birds were surveyed within a 50m radius using point counts. Local habitat features were estimated at survey points using a modified releve; and landscape variables such as amount of certain habitats and border types within circles of 200 and 500m radii of each point were calculated from the GIS coverages. Twenty-eight bird species comprised 90% of the individuals detected. Statistical analyses of habitat relationships were conducted for these species plus 6 less common species of management concern. I reduced the number of potentially meaningful habitat variables with a crude stepwise regression analysis. Using 1995-96 data, maximum likelihood estimation was used to fit negative binomial models of bird counts to these habitat variables. I used likelihood ratio tests to further simplify the negative binomial models by eliminating unimportant variables. The resulting models were then validated using data from 1994 and 1997. For the 28 common species, consistent significant relationships were only found for Red-winged Blackbirds, Common Grackles, Grey Catbirds, and Song Sparrows. For the 6 less common species, consistent relationships were found for Cerulean Warblers and Brown Creepers. Thus, most breeding songbirds in Upper Mississippi River floodplain forests are habitat generalists, at both the "local" and landscape scale. These forests are unique when compared to upland forests. They are dominated heavily by silver maple and their vegetative diversity is relatively low, yet bird species diversity and numbers of individual birds detected per survey is very high. (C3 - Habitat Relationships and Conservation: 4/29 - 1:30)

34. **ARE SAGE GROUSE AN APPROPRIATE UMBRELLA SPECIES FOR MANAGING SAGEBRUSH STEPPE HABITATS?** *STEVEN T. KNICK, U.S.G.S., Forest and Rangeland Ecosystem Science Center, Boise, ID; JOHN T. ROTENBERRY, Department of Biology, University of California, Riverside, CA.

Extensive loss of sagebrush (*Artemisia tridentata*) steppe communities throughout the Intermountain West is a major factor causing population declines of Sage Grouse (*Centrocercus urophasianus*). Two subpopulations of Sage Grouse currently are possible candidates for listing under the Endangered Species Act. Consequently, land management decisions are driven by the need to provide critical habitat for Sage Grouse. Proponents of this strategy for habitat management, based on using the Sage Grouse as an umbrella species, also have explicitly assumed that other shrubland obligate birds, also experiencing population declines, will benefit similarly. For this strategy to succeed, the spatial extent of habitats selected by all species must overlap considerably and management must be at the appropriate spatial resolution. We propose a hierarchical concept of habitat selection, in which Sage (*Amphispiza belli*) and Brewer's (*Spizella breweri*) sparrows always are present in habitats used by Sage Grouse. However, Sage Grouse often are absent from many regions used by Sage and Brewer's sparrows. Comparison of nonspatial models of habitat selection, such as those developed by previous research on Sage Grouse to form the basis for the management philosophy, will only demonstrate differences and not the spatial extent of those differences in habitats used by each species. Therefore, the analysis to test the validity of the management strategy must be based on maps of predicted use areas and at the resolution of management decisions on land use. We suggest that managing sagebrush regions based on habitat requirements of Sage Grouse may result unintentionally in some species getting drenched because they do not fit under the umbrella. (C4 - Habitat Relationships and Conservation: 4/29 - 4:00)

35. **EGG-SIZE VARIATION IN THE ACORN WOODPECKER**. *WALT KOENIG, Hastings Reservation, UC Berkeley; MARK STANBACK, Dept. Biology, Davidson College, Davidson, NC; JOEY HAYDOCK, Hastings Reservation, UC Berkeley.

We examined patterns of egg-size variation in the cooperatively breeding Acorn Woodpecker in central coastal California. Egg size was significantly repeatable and heritable. Egg size correlated positively with female body size and condition, increased with age, and varied significantly within clutches, with the first and last eggs being relatively small compared to eggs laid in the middle. We detected no evidence of facultative modification of eggs either in overall size, or relative to each other, between joint-nesting females beyond what would be expected given that such birds are generally close relatives. We also found no evidence that egg size varied in relation to group size or clutch size. Within years, egg size increased seasonally in conjunction with increasing temperatures. Contrary to the assumption of virtually all prior studies, however, eggs following large acorn crops when food was relatively abundant and reproductive success high were significantly smaller, not larger, than when conditions were poor. The selective advantage of this pattern may be the ability of the larger hatchlings emerging from larger eggs to survive longer when food is relatively scarce. These results counter the expectation that eggs are necessarily larger when food is plentiful despite the widespread pattern that females in better condition lay larger eggs. (B3 - Physiology, Morphology, and Disease: 4/28 - 3:30)

36. ***ALTERNATIVE PROCESSES THAT PRODUCE EDGE EFFECTS IN BIRDS OF CALIFORNIA COASTAL SAGE SCRUB**. WILLIAM B. KRISTAN*, Department of Biology, UC Riverside; JOHN T. ROTENBERRY, Department of Biology, UC Riverside; ANTONY J. LYNAM, Wildlife Cons. Soc.; and MARY V. PRICE, Department of Biology, UC Riverside.

The effects of urbanization upon adjacent wildlands may affect the distribution and abundance of birds. Some edge effects, such as behavioral responses to edges by species or their predators, will alter populations even if the habitat near the wildland-urban edge is unchanged. However, urban edges alter adjacent vegetation, such that an edge-animal abundance relationship could be produced by an animal's habitat associations. We studied whether urban edges altered habitat characteristics, and whether habitat and edge independently affected the distribution of birds and carnivores in coastal sage-scrub (CSS) at three sites in southern California. The effects of habitat were explored by using two different methods. For the first method we directly used the vegetation measured from this edge study to derive animal/habitat relationships, and for the second method we used independently derived predictive models of species-habitat relationships, which were then applied to the vegetation from this study to predict the probability of the species' presence. Five birds and five carnivore species exhibited direct responses to proximity to edge, independent of the vegetation. In addition, two species of birds responded to vegetation gradients that coincided with distance from edge, and the effects of edge on these species was due to habitat degradation. We show that changes in abundance at edges can result from either direct effects of edge or indirect effects of edge via changes in habitat. (A3 - Conservation: 4/28 - 4:30)

37. **NEST PREDATORS AND NESTING SUCCESS OF THE DUSKY FLYCATCHER IN A MANAGED PONDEROSA PINE FOREST**. *JOSEPH LIEBEZEIT and T. LUKE GEORGE, Department of Wildlife, Humboldt State University, CA.

We estimated nesting success and identified nest predators of the Dusky Flycatcher (*Empidonax oberholseri*) during 2 field seasons. Overall, nest predation was the most important cause of nest failure (91.6%, n=118). Nesting success in 1998 was 36% (n=53) and 29% (n=65) the following year. Daily survival rate (DSR) was not significantly different (P>0.05) between nest stages in 1998. However, in 1999, DSR was significantly lower in the nestling stage than in both the incubation (P=0.003) and laying stages (P=0.03). We successfully recorded 21 predation events using surveillance cameras. Sciurid mammals were the most common nest predators (12 of 21, 57%). The remaining predators were birds. Predation events were typically diurnal (18 of 21, 85.7%). DSR did not differ significantly between camera-monitored and manually monitored nests (P>0.05) suggesting the presence of cameras did not affect nesting success. We examined nest-site selection by comparing habitat attributes collected at nests and paired random sites. Matched-pairs logistic regression was used for this analysis. Parsimonious models, as selected by stepwise regression, predict that Dusky Flycatchers nested in larger substrate patches with greater shrub cover than at random sites in both years. We also compared habitat attributes at successful versus depredated nests using logistic regression. In 1998, the best models predict that successful nests were associated with steeper slopes, fewer branches supporting the nest, and a greater number of trees, logs, and stumps than depredated nests. In 1999, successful nests had greater shrub cover and more branches supporting the nest than depredated nests. Nest-site selection results support both the total-foliage and potential-prey-site hypotheses (Bowman and Harris 1980, Martin 1993). However, only the 1999 comparison of habitat attributes at successful versus depredated nests support these hypotheses. (B2 - Nest Selection: 4/28 - 2:00)

38. **MORPHOLOGICAL MECHANISMS OF SEASONAL ACCLIMATIZATION IN THREE SPECIES OF RESIDENT PASSERINES**. *ERIC T. LIKNES and DAVID L. SWANSON, Department of Biology, University of South Dakota, Vermillion, SD.

Improved winter cold-tolerance is widespread among small birds, but acclimatization mechanisms are incompletely understood. Improved cold tolerance in winter is usually associated with elevated peak metabolic rate (PMR) in small birds showing marked winter increases in cold resistance. Elevated PMR may be achieved by two general and non-mutually exclusive mechanisms, 1) elevated organismal aerobic capacity, and 2) elevated mass-specific aerobic capacity. Elevated organismal aerobic capacity may be achieved by hypertrophy of thermogenic tissues (skeletal muscle) and, perhaps, viscera, thus elevating PMR and basal metabolic rate (BMR), respectively. This study investigates seasonal changes in masses of skeletal muscles and viscera of three resident passerine species, White-breasted Nuthatch (*Sitta carolinensis*), Black-capped Chickadee (*Poecile atricapillus*), and House Sparrow (*Passer domesticus*), with characteristically large winter elevations in PMR (>35%). ANCOVA analyses of organ masses were performed using body mass - organ mass as a covariate to eliminate part-whole correlation effects. Preliminary data suggests that body mass, liver mass, proventriculus mass, and supracoracoideus mass were seasonally constant in all species. Heart and stomach masses increased in winter in all species, although the stomach components (proventriculus and gizzard), did not necessarily vary seasonally. Sparrows and chickadees, but not nuthatches, showed winter hypertrophy of pectoralis muscles, the primary thermogenic organ. Nuthatches exhibited winter hypertrophy of the gizzard, but not of any skeletal muscles. Winter pectoralis muscle hypertrophy may contribute importantly to winter acclimatization in chickadees and sparrows. The mechanism by which nuthatches achieve elevated winter PMR, which is among the highest values recorded (55%), is yet unknown.

39. **COMPARING PERFORMANCE OF SPECIES DISTRIBUTION MODELS USING HISTORIC RECORDS OF BIRDS IN THE ATLANTIC FORESTS OF BRAZIL.** *BETTE A. LOISELLE, Department of Biology, University of Missouri-St. Louis, St. Louis, MO; CATHERINE GRAHAM, Jet Propulsion Laboratory, Pasadena, CA.

We used several different models to predict historic distributions of birds in the Atlantic forests of Brazil. Species distribution models are increasingly used in influencing conservation decisions. Yet, markedly different predictions can result depending on the model used. To evaluate species distribution models, we used birds from the Cotingidae and Pipridae. Historic records for these birds were gathered from museums and private collections in North America and Brazil; a total of 276 independent localities were included in this data set. Environmental data were digitized from the National Atlas of Brazil (temperature, rainfall, geology, effective humidity, elevation) or obtained in digital form from other sources (vegetation, soils). We used four different models to generate hypotheses about the historic distribution of species using bird locality and environmental data. We then evaluated these models based on an examination of the resultant confusion matrices. This matrix includes two types of errors: false positive (comission) and false negative (omission). Models used included logistic regression, bioclimatic envelope, GARP, and a simple overlay model. Preliminary results indicate that GARP and simple overlay models had fewer errors than either bioclimatic or logistic regression models. Moreover, that all models performed significantly better for species with more narrow geographic ranges than species with wider geographic ranges. The potential consequences of using such models for conservation decisions is discussed. (C3 - Habitat Relationships and Conservation: 4/29 - 2:30)

40. **WINTER DISTRIBUTION SURVEYS OF THE WILLOW FLYCATCHER IN PANAMA AND EL SALVADOR.** *JANET C. LYNN; MARY J. WHITFIELD, Kern River Research Center, Weldon, CA.

Increased management and conservation concerns for the Southwestern Willow Flycatcher, *Empidonax trailli extimus*, have fueled research, which seeks a better understanding and knowledge of their natural history and biology on the breeding grounds. In contrast, recent studies in Costa Rica by Koronkiewicz et al. in 1998 and Koronkiewicz and Whitfield in 1999 have focused on wintering biology, in order to provide a more complete account of the Willow Flycatchers lifecycle. To continue with this effort, we surveyed for wintering Willow Flycatchers in Panama and El Salvador during January and February of 2000. Our goals were to identify wintering locations using tape-playback methods, describe habitat types where willow flycatchers were detected and identify possible threats to the wintering grounds. Habitats surveyed ranged from tropical lowland evergreen and deciduous forests to freshwater lagoons and marshes. Of 23 sites surveyed at 11 locations in Panama, we found 68 birds at 9 sites. In contrast, of 28 sites surveyed at 10 locations in El Salvador, we found 274 birds at 24 sites. All willow flycatchers were detected in lowland areas containing some element of slow moving or standing water along with shrubs and trees. (A1 - Migration: 4/28 - 11:30)

41. **SEASONAL ROOST FLOCK DYNAMICS AND TREE USAGE BY NATURALIZED PARROTS IN THE SAN GABRIEL VALLEY, CALIFORNIA**. KAREN T. MABB* and MELANIE A. STALDER. Department of Biology, California State Polytechnic University, Pomona, CA 91786.

We counted parrots at evening roost sites in Arcadia and Temple City, California, and noted parrot species and roost tree type on 174 days between May 1995 and February 2000. Roost flocks were composed mainly of Red-crowned (*Amazona viridigenalis*) and Lilac-crowned (*A. finschi*) parrots, but seven other parrot species were present among the roosting flock. Three other parrot species occurred in the area but did not roost with the main parrot flock. Deciduous trees were preferred over evergreen trees for roosting; usage of evergreens was highest in winter. Monthly average evening roost flock size fluctuated seasonally, with higher counts in fall/winter (peaking at an average of 522 parrots in December). The lowest counts were in spring/summer (lowest monthly average was 107 parrots in April), presumably due to breeding activity and a wider availability of suitable roost trees.

42. ***NEST SITE SELECTION AND NEST PREDATION IN AN EARLY SUCCESSIONAL HABITAT**. *JAMES S. MARSHALL. Environmental Science and Forestry, SUNY-College of Environmental Science and Forestry, Syracuse, NY.

I investigated the vegetation around the nests of birds in a power line right-of-way. Given that nest predation is one of the most important causes of nest failure, I hypothesized that birds would choose nest sites that reduced the probability of predation. I assumed that high stem density around a nest would limit nest detection and predator accessibility, and therefore that successful nest sites should have more stems per unit area than unsuccessful nest sites. While birds did choose nest sites with higher stem densities than were generally available, successful nests did not have higher stem densities than unsuccessful nests on a community-wide basis. Tests on individual species had mixed results. This suggests that although some species may choose nest sites in order to reduce predation, other species choose nest sites based on other criteria. To manage habitat for the conservation of certain species, we need to understand how birds use that habitat. (B2 - Nest Selection: 4/28 - 2:45)

43. **RECONSTRUCTING THE PRIMITIVE VOCAL REPERTOIRE OF THE PARIDAE: COMMONALITIES OF TWO CLADES**. ARCH MCCALLUM, Dept. of Biology, College of Charleston, SC 29424.

The Paridae have some 70 species, and by all criteria would seem to be evolutionarily "successful." One genetically well-defined clade (including great tits and blue tits) features bright colors, badges of rank, and large song repertoires, while the other (including chickadees, coal tits, and crested tits) features structured social organization, caching, and spatial memory. Does the more social clade feature more complex vocal repertoires, as its social complexity might suggest? A qualitative review of repertoire organization does not support this hypothesis. Most importantly, Great Tits (*Parus major*) have a combinatorial "chick-a-dee" call imbedded in a richer combinatorial system. At what stage in parid evolution did the complex combinatorial calling found in both clades arise? The Verdin (*Auriparus flaviceps*), basal member of the sister family, Remizidae, offers few clues, as it appears to lack a combinatorial calling system. When one examines molecular phylogenies of the Paridae, the surprising result is that the relatively simple repertoires of coal tits (*Periparus*) and crested tits (*Lophophanes*) appear derived. Great Tits and Bridled Titmice (*Baeolophus wollweberi*), the basal members of the two clades, not only have combinatorial "chick-a-dee" calls with similar transition probabilities, the note-types used in them are quantitatively indistinguishable. It seems, on present evidence, that combinatorial calling is a primitive characteristic of the entire family Paridae. Perhaps it was a key innovation in their successful exploitation of woodland and forest habitats on four of the world's continents. (B1 - Song: 4/28 - 11:15)

44. **AMMONOTELY AND NITROGEN EXCRETION IN THREE SYMPATRIC HUMMINGBIRD SPECIES**. TODD J. MCWHORTER, Department of Ecology & Evolutionary Biology, University of Arizona, Tucson, AZ; DONALD R. POWERS, Biology Department, George Fox University, Newberg, OR; *NATHAN MILLER, Biology Department, Linfield College, McMinnville, OR.

When hummingbirds encounter low ambient temperatures or energy-dilute floral nectars, they must consume food at exceedingly high rates to meet energetic demands. Under these conditions, they often experience water flux rates more similar to freshwater fish or amphibians than to terrestrial vertebrates. It has been suggested that under some conditions, hummingbirds may be facultatively ammonotelic. We examined nitrogen excretion in three sympatric hummingbird species in southeastern Arizona (*Archilochus alexandri*, *Eugenes fulgens*, *Lampornis clemenciae*). Archilochus excreted roughly equal amounts of nitrogen as ammonia and uric acid, whereas the other two species excreted nitrogen primarily as uric acid. Proportion of nitrogen excreted as ammonia did not vary with water flux or nitrogen intake rates. Although we found intriguing interspecific differences, our results cast doubt on the notion that hummingbirds can vary degree of ammonotely with water flux rate. Our study also allowed calculation of nitrogen requirements, which were similar for all three species and comparable to previously reported values for hummingbirds.

45. **USING STABLE ISOTOPES OF HYDROGEN IN FEATHERS AND PRECIPITATION TO ESTIMATE THE NATAL LATITUDES OF IMMATURE COOPER'S HAWKS MIGRATING THROUGHOUT THE FLORIDA KEYS**. *TIMOTHY D. MEEHAN, Department of Wildlife, HSU, Arcata, CA; CASEY A. LOTT, HawkWatch International, SLC, UT; ZACHARY D. SHARP, Department of Earth and Planetary Sciences, UNM, ABQ, NM; RUTH B. SMITH, HawkWatch International, SLC, UT; ROBERT N. ROSENFIELD, Department of Biology, UW, Stevens Point, WI; ANDY STEWART, Victoria, BC.

The counting of raptors during migration has yielded valuable information on abundance trends and is considered an important tool for estimating raptor population status at a regional scale. One problem plaguing the interpretation of raptor migration count trends is that researchers have a poor understanding of where monitored migrants are coming from. Recently, techniques have been pioneered that use the relationship between stable hydrogen isotope ratios in feathers (dDf) and growing season precipitation (dDp) to link the wintering and breeding locations of migratory songbirds. We were interested in using these techniques to learn the origins of raptors counted at migration sites. Thus, we constructed a predictive regression model for the relationship between the dDf values of nestling Cooper's Hawks and dDp values at five locations across the latitudinal extent of the species breeding range. The model ($dDf = -27 + 1.1\ dDp$, $r2=0.87$, $n=68$, $p<0.0001$) was similar to models produced by researchers working with songbirds. We used the model to inversely predict dDp values corresponding with dDf values from 48 immature Cooper's Hawks captured during migration in the Florida Keys. These inversely predicted dDp values were compared to a published map of the dDp values of North American growing season precipitation to produce new information on the latitudinal origins of the migrants. We learned that immature Coopers Hawks migrating through the Florida Keys do not originate at latitudes throughout the species breeding range in eastern North America. Instead, a majority of the individuals appear to migrate from natal areas in the Mid-Atlantic and Southeast regions of the continent. This information promises to aid the interpretation of abundance trends generated from the ongoing Florida Keys migration count. (A1 - Migration: 4/28 - 11:15)

46. **MOLECULAR PHYLOGENETICS OF THE KINGBIRDS AND THEIR ALLIES**. JASON A. MOBLEY; Museum of Vertebrate Zoology and Department of Integrative Biology, University of California, Berkeley, CA.

Tyrant Flycatchers (Tyrannidae) have been the subject of a wide variety of ecological and behavioral studies that are limited by the lack of a reasonable understanding of the evolutionary relationships in this large and complex group. Tyrannid species have traditionally been grouped according to similarities in tarsal scutellation, plumage, bill, syrinx, and skull morphology. Many of these characters are known to be highly convergent, making them potentially unreliable for delimiting groups of closely related species. I will present a novel phylogenetic hypothesis for the species of Kingbirds (*Tyrannus*) and their allies (*Griseotyrannus*, *Empidonomus*, *Megarhynchus*, *Tyrannopsis*, *Myiodynastes*, *Conopias*, *Myiozetetes*, *Legatus*, *Philohydor*, *Pitangus*, and *Phelpsia*) based on an 850 bp portion of the mitochondrial cytochrome B gene. I will compare this to previous hypotheses of historical relationships among the genera that comprise this group based largely on morphology of the syrinx, skull, and nest type. The molecular data set contains significant phylogenetic signal and indicates strong support for many of the recognized groups. However, there is some degree of conflict concerning relationships among genera and a lack of complete resolution within *Tyrannus*, suggesting that additional markers are necessary to realize a well supported species phylogeny for this group. (A2 - Systematics: 4/28 - 2:00)

47. ***LACK OF AN URBAN EDGE EFFECT ON REPRODUCTIVE DEMOGRAPHY OF AN AREA-SENSITIVE SPARROW.** *SCOTT A. MORRISON Department of Biology, Dartmouth College, Hanover, NH; DOUGLAS T. BOLGER Environmental Studies Program, Dartmouth College, Hanover NH.

The Rufous-crowned sparrow (*Aimophila ruficeps canescens*) is a ground nesting, non-migratory passerine that exhibits an area-sensitive distribution pattern in fragmented coastal sage scrub habitat in San Diego, CA, USA. From 1997 to 1999, we monitored the seasonal fecundity of Rufous-crowned sparrows occupying breeding territories near edges of residential development (<< 250m from urban edge) and in habitat interior areas (>500m from edge). Daily nest predation rates were high but did not differ between edge and interior areas. Video monitoring of real nests revealed that snakes were the principal nest predators. The lack of an edge effect on nest predation rate is likely due to a lack of edge sensitivity of snakes; snake encounter rates did not differ between edge and interior areas. No cowbird brood parasitism was observed in any of 266 nests. Reproductive output displayed substantial annual variation due to an El Niño-Southern Oscillation event; reproductive output was highest in the wet El Niño year and lowest during the dry La Niña. Total reproductive output did not differ between edge and interior in any year of the study, although more frequent renesting by RCSP in edges compensated for slightly lower brood sizes in edges in some years. The lack of a difference in reproductive output between edge and interior habitat despite the considerable climatic fluctuation characteristic of this region suggests that processes other than those affecting nest success in habitat edges generate the fragmentation-sensitivity in this species. These results caution against generalizing across habitat types and species when anticipating potential fragmentation effects. (A3 - Conservation: 4/28 - 4:15)

48. **THE STATISTICAL ANALYSIS OF NESTING SUCCESS USING TIME-TO-FAILURE ANALYSIS, AN ALTERNATIVE TO THE MAYFIELD METHOD: AN EXAMPLE USING LOGGERHEAD SHRIKES.** *NADAV NUR, AARON HOLMES, and GEOFFREY R. GEUPEL, Point Reyes Bird Observatory, Stinson Beach, CA; KENT LIVEZEY, U.S. Navy, Engineering Field Activity NW, Poulsbo, WA; RUSS MORGAN, Oregon Department of Fish and Wildlife, Heppner, OR.

The most common method used by ornithologists for estimating nesting success is the Mayfield method. Studies have confirmed that this method produces unbiased estimates of nesting success, provided that assumptions of the method are met. However, limitations of the Mayfield method are two-fold: (1) assumptions (e.g., time-constant probability of nest failure during the respective period) are unlikely to be met in field studies and (2) inability to statistically model nest failure in relation to one or more quantitative variables simultaneously. Here we demonstrate an alternative method, time-to-failure analysis (TTFA), also termed "survival analysis", first developed for epidemiological studies. TTFA can easily incorporate left-censoring (nests are found at different points in the nesting cycle) and right-censoring (ultimate outcome of a nest-success or failure-is unknown). Sophisticated models can be developed incorporating, for example, random effects, and time-varying covariates. To demonstrate this method we analyze data on Loggerhead Shrike (*Lanius ludovicianus*) nests, collected as part of a three year monitoring program on the Naval Weapon Systems Training Facility, Boardman, OR. This 19,020 ha facility represents one of the largest remaining tracts of shrubsteppe habitat in the Columbia Basin. All nests (n = 146) were located in sagebrush habitat, dominated by *Artemisia tridentata*. The entire study area (2500 ha) was surveyed systematically and nests were monitored every 1 to 4 days. We evaluate nesting success with respect to clutch initiation date and height of nest from ground. We also test the assumption that nest failure is constant over time. Our estimates of daily nest survival for this population are lower than reported values (using the Mayfield method) from 14 previous studies. Low nesting success may account for the population decline of 2.7% observed for the Interior Columbia River Basin. (B2 - Nest Selection: 4/28 - 2:30)

49. **TIMING OF CLUTCH-INITIATION IN RELATION TO THE TIDAL CYCLE BY TIDAL MARSH SONG SPARROWS: AN ADAPTATION TO AVOID FLOODING?** NADAV NUR and HILDIE SPAUTZ, Point Reyes Bird Observatory, Stinson Beach, CA.

Since 1996, we have been studying the population biology of three endemic subspecies of Song Sparrow (*Melospiza melodia*), each confined to salt marsh habitat in the San Francisco Estuary: the Suisun, Samuel's and Alameda Song Sparrows. Song Sparrows, like other tidal marsh ground-nesting birds, are vulnerable to nest failure due to flooding by monthly high tide events. They may minimize losses by building nests above the high water level or by timing attempts so that the most vulnerable period (the early nestling period, up to day 8) occurs when tides are lower. We investigated temporal patterns of clutch initiation by Tidal Marsh Song Sparrows at five marshes (two in Suisun Bay, three in San Pablo Bay) which differed with respect to maximum tidal influence and nest substrate availability. Both the Suisun and Samuel's (San Pablo) Song Sparrows showed a significant tendency to initiate clutches on or just after the high tide for the month, but this pattern was apparent only for the first two months of the breeding season (March - April or April - May). In the second half of the breeding season (during which time second, third or fourth nesting attempts are initiated) there was no such synchronization of clutch initiation with high tide events. The pattern observed in the early breeding season appears adaptive, since the nesting period (from laying of the first egg to fledging) is only about 25 days, whereas the period between monthly high tides is about 28 days. One possible mechanism by which Song Sparrows may time their clutch initiation is the lunar cycle. To evaluate this possibility, we compare clutch initiation in tidal marsh Song Sparrows with the same parameters observed in a long-term study population of upland Song Sparrows breeding at the nearby Palomarin Field Station.

50. ***MOLECULAR GENETIC STRUCTURING AND DEMOGRAPHIC HISTORY OF THE WILLOW FLYCATCHER**. EBEN H. PAXTON, Northern Arizona University and U.S.G.S., F.R.E.S.C., Colorado Plateau Field Station, Flagstaff, AZ.

The willow flycatcher (*Empidonax traillii*) has long been considered a polytypic species, with four subspecies typically recognized. The morphological characters used to separate the subspecies are subtle, making identification of the subspecies difficult. I present the results of a molecular genetic review of the subspecies division in the willow flycatcher. Using sequences from the mitochondrial cytochrome-b gene and the nuclear DNA Amplified Fragment Length Polymorphism (AFLP) technique, I examined over 180 willow flycatchers from across the willow flycatcher's range. Overall, I found significant differences between all but one pairwise comparison of willow flycatchers subspecies. Additional analysis of genetic patterns suggests the willow flycatcher historically went through a period of low population numbers followed by a period of rapid population growth. In addition, the endangered southwestern willow flycatcher (*E. t. extimus*) shows slight signs of a genetic bottleneck from its very recent population decline. (A2 - Systematics: 4/28 - 2:30)

51. **USE OF THREE SONG TYPES IN DIFFERENT CONTEXTS BY WILLOW FLYCATCHERS.** CHRISTINE M. PAYNE, Department of Zoology, University of Western Ontario, London, ON; *M. ROSS LEIN, Department of Biological Sciences, University of Calgary, Calgary, AB.

Male Willow Flycatchers (*Empidonax traillii*) possess three song types ("fitz-bew", "high fitz-bew", and "creet") that are delivered with immediate variety during territorial singing. We investigated singing behavior of 10 mated males in a population in southwestern Alberta, Canada to determine whether the song types are functionally equivalent. We recorded songs of males, along with a continuous verbal record of male behavior, during 10-minute observations throughout the breeding season. We transcribed recordings and identified territorial position (center or edge) for each song and target behaviors (taking flight, landing, preening or hawking) occurring within specified time interval (10, 20, or 30 s) before or after each song. We used ANOVA and ANCOVA to determine associations between song types and territorial position or behavior. The position of a male on his territory did not affect the relative probability of any song type. The only significant association of song types and target behaviors was for "creet". This song type was more probable than other song types within 10 s after taking flight, and more probable than "high fitz-bew" songs within 10 s after landing or hawking. We conclude that the "fitz-bew" and "high fitz-bew" song types are functionally equivalent, but that the "creet" song type encodes a specific message relating to the probability of locomotory behavior.

52. **PREY AVAILABILITY AND DIET IN RELATION TO POST-FIRE HABITAT USE BY THE BLACK-BACKED WOODPECKER.** HUGH D.W. POWELL, Division of Biological Sciences, University of Montana, MT.

Fire suppression and salvage logging of burned forests have combined to severely reduce the amount of available post-fire habitat for the Black-backed Woodpecker (*Picoides arcticus*). Their conservation depends in part upon identifying important resources for retention when habitat is to be logged. If food availability influences woodpecker foraging behavior in post-fire forests, then prey-rich patches (or individual trees) existing among prey-poor patches might be important to conserve.

I measured diets and recorded foraging behavior and habitat use of Black-backed Woodpeckers. I compared tree species use to availability, as estimated from systematic samples. Using a bark-sampling method derived from bark beetle literature, I compared infestation levels between fed-upon and random trees, among tree species and, at one site, among patches of trees. At both sites, trees that birds used for foraging contained more prey than trees selected at random. Both insect infestation of tree species and tree species use by woodpeckers differed between sites, suggesting that the foraging value of a particular tree species depends on its level of infestation and cannot be generalized across sites. While prey density appears to be an important variable to measure, not all prey-rich tree species were used disproportionately often, and prey-rich patches were not used more often than patches with lower mean prey density. The primary prey at both sites was woodboring beetle larvae (Coleoptera: Buprestidae, Cerambycidae), and these composed the majority of the sub-bark insect biomass. In other habitats offering different insect assemblages, Black-backed Woodpecker diet might well be different, underscoring the necessity of sampling available insect populations when making generalizations about a species' diet. Documenting the breadth of Black-backed Woodpecker diet given different prey availabilities could illuminate the relative suitabilities of different forest or disturbance types as habitat for this species. Using this line of reasoning, I discuss the possible benefits of bark beetle outbreaks vs. post-fire forests for foraging Black-backed Woodpeckers. (C1 - Foraging Behavior and Ecology: 4/29 - 10:00)

53. **COMPARATIVE PHYLOGEOGRAPHY OF THE BREEDING LANDBIRDS OF THE ALEUTIAN ISLANDS**. *CHRISTIN L. PRUETT and KEVIN S. WINKER, University of Alaska Museum and Department of Biology and Wildlife, University of Alaska, Fairbanks, AK.

It is well understood that communities are comprised of species having independent phylogenetic and biogeographic histories. However, vicariant events can and often do impose broad, heterospecific patterns across communities. Simple, high-latitude communities should be those most likely to be comprised of species sharing biogeographic histories because there is a strong likelihood that member species colonized formerly glaciated areas as they became available. We test this hypothesis in the Aleutian Island archipelago of western Alaska among eight species of co-distributed landbirds using mtDNA sequence data. We analyzed the cytochrome b gene of Rock Ptarmigan (*Lagopus mutus*), Rock Sandpiper (*Calidris ptilocnemis*), Common Raven (*Corvus corax*), Winter Wren (*Troglodytes troglodytes*), Song Sparrow (*Melospiza melodia*), Lapland Longspur (*Calcarius lapponicus*), Snow Bunting (*Plectrophenax nivalis*), and Gray-crowned Rosy-finch (*Leucosticte tephrocotis*) from Attu Island, Adak Island, and a mainland location. Although the species examined are currently co-distributed, patterns of haplotype distributions and sequence divergence are not similar. Lapland Longspurs, used as a control because of their migratory behavior, showed no discernable pattern of divergence, as expected. However, several species (Rock Ptarmigan, Common Ravens, Song Sparrows, Snow Buntings, and Gray-crowned Rosy-finches) exhibited similar patterns of low-level divergence between the Aleutian Island locations and the mainland. Winter Wrens and Rock Sandpipers showed the highest levels of divergence with several base change differences between the three locations. Our findings do not support the hypothesis of a single community wide landbird colonization of the Aleutian Islands. Instead, they suggest a complex history of isolation and colonization. Beringian refugia and species-specific colonization of this high-latitude archipelago are suggested. (A2 - Systematics: 4/28 - 2:45)

54. **LARGE-SCALE PATTERNS OF BIRD DISTRIBUTION FROM INTENSIVE SURVEYS**. C. JOHN RALPH, BILL HOGOBOOM, (U.S. Forest Service, Redwood Sciences Laboratory, Arcata, California); and JOHN ALEXANDER (Klamath Bird Observatory, Ashland, Oregon).

We analyzed more than 8,000 point counts taken over a 7 year period on approximately 6300 stations in the Klamath Bioregion of Northern California and Southern Oregon. Our study covers some 5.4 million hectares from the Rouge River on the north, to the Russian River on the south, and east into the headwaters of the Klamath and Sacramento Rivers. We found bird species abundance heterogeneity on several scales that we considered. Although we covered many habitats from coastal forests to inland sagebrush, much of the habitats are mixed conifer forest. Even within this single habitat type, we found marked differences in bird distribution and abundance. The species that specialized in certain habitats were largely those predicted by Delphi techniques, such as the California Wildlife Habitat Relationships Program, but with interesting exceptions. We also examined the ecological correlates of widely-distributed, versus localized species. The habitat relationships of these latter species showed a great deal of habitat specificity. We found models of habitat relationships in which vegetation and landscape variables explained much of the abundance of the birds, as compared to other studies that have found relatively little relationship. Habitat was analyzed on several scales. On a small scale, habitat information came from vegetation surveys conducted on a radius of 50 m around each station, while at the landscape scale, analysis was made using a Landsat derived vegetation layer. We have found instructive differences at the two scales, as some bird species are responding at one, and not the other scale. (C4 - Habitat Relationships and Conservation: 4/29 - 3:30)

55. **DIFFERENCES IN RELATIVE ABUNDANCE AND SPECIES RICHNESS OF BIRDS IN MULTIPLE-AGED VEGETATION COMMUNITIES: IMPLICATIONS FOR FIRE MANAGEMENT.** JENNIFER L. RECHEL. USDA Forest Service, Forest Fire Laboratory, Riverside, CA.; DAVID A. LARSON, USDA Forest Service, San Dimas Experimental Forest, Glendora, CA.

We examined patterns of avian species richness and relative abundance for breeding birds in five major habitats in the San Dimas Experimental Forest, Angeles National Forest. We analyzed the relationships between habitats, including age of the stand based on the number of years since the last fire, in riparian, mixed chaparral, mixed oak woodland, mixed conifer, and mixed big-cone Douglas fir/oak woodland communities. Data were collected from 1997 - 1999 during the late spring and early summer (March - June) on 107 fixed circular point plots using trained observers. Age of the plots ranged from 10 years to > 70 years since the last fire. Typically, decisions about protecting avian habitats from fire on National Forest lands in the diverse and complex Mediterranean ecosystems have been based on limited analyses such as the number of years since the last fire and the size of the habitat patch. To address these complex patterns and quantify the variations in these patterns, we did a principal component analysis that included 15 habitat variables. Our analysis showed that 83% of the total variation in species richness and relative abundance can be explained by a combination of % shrub cover, % tree canopy cover, shrub species richness, tree species richness, and precipitation. These preliminary results suggest that patterns of species richness and relative abundance of birds on the San Dimas Experimental Forest are associated with high shrub canopy cover and high tree and shrub richness and not strictly age and size of the vegetation plot. Both species richness and relative abundance are minimal in mixed coniferous and mixed oak woodlands characterized by low herbaceous cover and low species richness. Management and research decisions about fire suppression and policies should not rely results based solely on the age and size of the habitat areas, but on combined information about the avian and vegetation community structures.

56. **ASSESSING BREEDING RIPARIAN BIRD ABUNDANCE WITH DIFFERENT SCALES OF HABITAT INFORMATION.** *TIMOTHY S. REDMAN, Department of Biology, University of California, Riverside, CA; JOSHUA J. TEWKSBURY, Department of Zoology, University of Florida, Gainesville, FL.

Ecologists have long recognized the positive association of species abundance and amount of suitable habitat. However, the importance of habitats to birds is often assessed by local habitat surveys that require time and labor intensive methods. Using 50-m fixed radius point counts, we estimated total abundance data for all avian species breeding in foothill and mountain riparian and quaking aspen (*Populus tremuloides*) habitats on the Bitterroot National Forest, western Montana. Overall species abundance was then regressed separately on three scales of habitat information: (1) local habitat variables (e.g., canopy cover and number of trees present in an 11.3-m radius circle around the point); (2) patch size (area of riparian patch in which point was located); and (3) landscape data (percent riparian and aspen habitat present in concentric rings at 500-m intervals from each census point). The patch size and landscape variables showed a similarly strong and statistically significant relationship to total riparian bird abundance. Percent area of riparian and aspen habitat in the 500-m, 2000-m, and 2500-m rings had strong relationships with overall abundance in the landscape model. The local habitat variables model yielded a weaker, non-significant relationship to overall abundance. These results suggest that landscape level information may be useful in assessing the value of habitat to breeding birds over large scales without requiring the labor and time of more detailed methods.

57. **MICROSATELLITE ANALYSIS OF MIXED MATING STRATEGIES IN BANK SWALLOWS, *Riparia riparia*.** *LETITIA M. REICHART, Department of Biology, Indiana University of Pennsylvania, Indiana, PA; ANTHONY J. NASTASE, Department of Biology, Indiana University of Pennsylvania, Indiana, PA.

One polymorphic microsatellite marker was used to investigate the mixed mating strategies of the North American Bank Swallow (*Riparia riparia*). Parentage analysis was done on 136 individuals in 24 broods from colonies located in Crawford County, PA. In forty-two percent of the broods, one or both of the putative parents were excluded. Seventeen percent of nestlings were identified as extra-pair young and 2% as parasitic young. The probability of detection for this locus was 0.46225. Results are comparable to those found by minisatellite analysis in European Sand Martins. Additional microsatellite markers are being investigated to increase the probability of detection of mixed mating strategies in this species.

58. PARADISE LOST/PARADISE FOUND? BIRD USE OF A TROPICAL TREE PLANTATION. JAMIE A. ROTENBERG, Department of Biology, University of California, Riverside, CA.

Tropical rainforest destruction and its adverse effects on bird species are well documented. Also well studied are cattle pastures and monoculture plantations that typically replace these forests. Past studies found these areas to be "tropical deserts," supporting low bird species diversity. What has happened to the original forest avifauna at these sites in light of anthropogenic change? Recently, coffee plantations were found to support large numbers of Neotropical migratory species. However, do other agricultural practices have the ability to carry a subset of the forest bird species that once lived in tropical lowland areas? I examined bird use in a Guatemalan *Gmelina arborea* plantation (as well as adjacent pure forest fragments and pasture sites) to assess its potential role in bird conservation and its suitability as habitat for forest bird species. Point counts and foraging observations on selected species were used to determine how birds utilized the plantation resources. Vegetation variables were also measured to evaluate habitat characteristics. These indicated that this plantation was not homogeneous, but included at least 5 distinct vegetation types based on structure and composition. These different types were largely differentiated by the degree to which plantation management incorporated pre-existing native habitat features (e.g., riparian vegetation, major canopy species). Bird species richness differed significantly among the habitats, and birds selected certain plantation habitats over others. The *Gmelina* plantation provided the structure necessary to support some forest species not found in surrounding pasturelands. Patterns of bird species presence or absence in these habitats were then examined to quantify the relationship among habitats and species. Detrended correspondence analysis (DCA) showed that habitats with greater vegetative complexity had more species in common to forest than to pasture, and that while pure *Gmelina* habitats still lacked many species, they were considerably richer than pasture. These findings suggest that a *Gmelina* plantation, if managed to retain natural areas, could be an important land-use alternative for the conservation of forest birds in the American tropics. (C3 - Habitat Relationships and Conservation: 4/29 - 2:15)

59. CAN HABITAT PREDICT THE ABUNDANCE OF SHRUBSTEPPE BIRDS? A 20-YEAR RETROSPECTIVE. JOHN T. ROTENBERRY, Department of Biology, University of California, Riverside, CA; *JOHN A. WIENS, Department of Biology, Colorado State University, Fort Collins, CO.

A fundamental premise of avian community ecology and habitat management is that the distribution of bird species is closely linked with habitat and that quantitative measures of habitat features can therefore be used to predict occurrence and abundance. We evaluate this premise using the results of a long-term study of shrubsteppe breeding bird communities. From 1977 to 1982, we surveyed bird communities and recorded habitat features at 14 sites in the shrubsteppe of Oregon and Nevada. In 1997 we repeated these surveys using the same procedures on the same transects with the same (albeit older) observers. The sites encompassed a broad range of the habitat variation that occurs within this ecosystem, yet these habitats had changed little over the 20-yr period. None of the widespread or numerically dominant bird species exhibited significant regional changes in abundance, although species abundances and community composition varied considerably among the sites and over time. We used multiple regression to develop models relating the abundance of the "core" shrubsteppe bird species to habitat variables for the 1977-1982 data set. Although these models were remarkably good (R^2 = 0.60 -0.82, all $P < 0.01$), they performed poorly in predicting bird abundances in 1997 based on the 1997 habitat measures. The failure of such statistically robust models suggests that much of the local, within-year variation in shrubsteppe bird abundances may be unrelated to proximate habitat conditions, at least within broad limits. This is what one might expect of an unsaturated, nonequilibrial, open community. Our findings are not encouraging to those who would use habitat models to manage wildlife populations. (C4 - Habitat Relationships and Conservation: 4/29 - 4:30)

60. WINTER AVIAN SURVEYS IN THE COASTAL WATERS OF SAN BLAS, NAYARÍT, MEXICO. *THOMAS P. RYAN, San Francisco Bay Bird Observatory, Alviso, CA; DANIEL A. KLUZA, University of Kansas, Department of Ecology and Evolutionary Biology, Lawrence KS; ARMANDO SANTIAGO No. 102 Sinaloa, San Blas, Nayarít, Mexico.

We conducted avian surveys of the shallow (< 80 m) coastal waters of San Blas, Nayarít, Mexico, from Isla Isabela, to Bahía de Matechén during the winters of 1997-1998, 1998-99, 1999-2000. We surveyed 600-m strips of ocean between 169 and 189 km in length, over three mornings. We used 8-m open hull fishing boats. Ocean temperatures fluctuated from warmer water, 26 to 27° C in 97-98, to cooler water 22.6-24.1° C in 98-99 and 21.1-23.8 in 99-00. We observed 24 species of bird. Comparing community similarity using the Sørenson Coefficient of Similarity, bird species in cool water years were more similar to each other (83.9%) than to warm water years (97-98 to 98-99, 68.8% and 97-98 to 99-00, 70.9%). We describe the winter avian community of this area. We estimate relative abundance and relative density of the avian community in this area. We compare abundance and diversity with published reports of surveys conducted near Islas Marias by Jehl (1973) and the Middle American Trench off the coast of Jalisco by Howell and Engel (1992). Avian abundance was higher near Islas Marias (238 bird/hr), than in the coastal waters of San Blas (77.7 to 115.1 birds/hr), and lowest over the Middle American Trench (30 birds/hr). We also discuss materials needed and the use of local resources to conduct preliminary avian surveys in tropical waters.

61. ***CLARK'S NUTCRACKER AND SOUTHWESTERN WHITE PINE: ANOTHER BIRD-PINE MUTUALISM.** *SHERIDAN SAMANO, Department of Biology, University of Colorado at Denver, Denver, CO; DIANA F. TOMBACK, Department of Biology, University of Colorado at Denver, Denver, CO.

Clark's Nutcrackers (*Nucifraga columbiana*) are effective seed dispersers for several western pine species, which we call "bird-dispersed" pines. *Pinus strobiformis*, southwestern white pine, exhibits some characteristics of a bird-dispersed pine, including large, wingless seeds, but its seed dispersal modes and cone ripening phenology are relatively unknown. Also, its cones are oriented at all angles from branch tips, including upright and pendulous. We examined the foraging interactions between Clark's Nutcrackers and *P. strobiformis* in the San Juan Mountains of Colorado from August 25, 1999 to September 29, 1999. Specifically, we studied cone orientation and cone ripening phenology of *P. strobiformis* and the effects on nutcracker behavior. We used the degree of cone scale separation as a measurement of seed ripeness and found asynchrony among and within canopies. We believe asynchronous ripening promotes avian seed dispersal by increasing the amount of time seeds are available. Seed harvest by nutcrackers was first documented while cones were still green and closed. Initial extraction rates were 43.7 seconds per seed. Seed harvest continued until all cones were open, and seeds were depleted. Final extraction rates were 10.2 seconds per seed. Extraction rates dropped as cones ripened, but total time spent foraging on individual trees also dropped, suggesting seed crop depletion. Horizontal-oriented cones comprised 36.1% of the cone crop. Nutcrackers preferred horizontal cones, and foraged on them 54.2% of the time. Nutcrackers avoided pendulous cones until scale separation was apparent. Nutcracker caching behavior was observed in the study area, but most seeds were transported to cache sites some distance away from the study area. Seedling clusters, evidence of animal dispersal, were also present in the study area. Our results show that there is a mutualistic relationship between Clark's Nutcrackers and *P. strobiformis* in areas of sympatry. Therefore, *P. strobiformis* can be classified as a "bird-dispersed" pine in at least part of its range. (C1 - Foraging Behavior and Ecology: 4/29 - 9:30)

62. **RESPONSES OF A BREEDING BIRD COMMUNITY TO A PATCHY FOREST LANDSCAPE IN GRAND TETON NATIONAL PARK.** GREGORY SCHROTT, Department of Organismic Biology, Ecology, and Evolution, University of California, Los Angeles, CA.

The lodgepole pine dominated forests of Grand Teton National Park in Wyoming provide a useful system for examining the tolerances of the local bird community for utilizing a fragmented forest landscape. The park consists of a large valley called Jackson Hole. The valley is ringed by mountains, the bases of which are covered by tens of thousands of hectares of unbroken forest. The center of the valley is flat and is primarily covered by sagebrush. A number of isolated patches of forest grow on the valley floor, primarily on the moraines of Pleistocene glaciers where the soil is more productive. These patches of forest range in size from less than 1 hectare to several hundred hectares. I divided the forest patches into 6 size classes and conducted fixed-radius point count bird censuses at 10 sites within each size class. Surveys were conducted for 3 breeding seasons. These data provided incidence curves for each bird species within the community. These are used to indicate their abilities to utilize a fragmented forest landscape. Examining the relationship between changes in incidence pattern and abundance can reveal preferences for utilizing certain sizes of forest patch. I argue that species which are found primarily in larger forest patches will be more at risk of local extinction in an artificially fragmented forest. The bird community in a 400-hectare forest patch is similar to that of unfragmented forest in the park. The fragmentation of this forest system also leads to qualitative habitat differences among sites in different sizes of forest patch. These differences are likely responsible for some of the distribution patterns observed in birds in these forests.

63. GUILD STRUCTURE OF THE GUANDAUSHI AVIAN COMMUNITY IN NON-BREEDING SEASONS. SHAO-PIN YO, Department of Zoology, National Chung Hsing University Taichung Taiwan

A systematic study of avian guild was conducted at Guandaushi LTER site with point count and mist net capture methods from October 1995 to December 1997. The main purpose of this study was to identify and analyze the structure of various avian guilds found in the forest ecosystems located at the middle and low elevations of Taiwan. Another purpose of this study was to apply the guild concept on the analysis of avian resource utilization patterns in order to evaluate the impacts of environment changes on bird community. The guild representing birds foraging on insect among bushes (IB) was the most abundant among the guilds. A 79.2% of birds counted was identified as insect eating birds in the ecosystem. Therefore, insect was the main food sources for the avian community at Guandaushi forest ecosystem. The species richness of IB guild was the greatest among the 14 guilds. The community structure in term of species richness, species diversity and species evenness varied among guilds. Guild IB and IM (birds foraging on insect at the middle section of a tree) represented the two extreme community structures of the 14 guilds. The IB guild is a heterogeneous community, while IM is a homogenous community. The community structure of bird found in different forest types and vegetation patterns varied. Cultivated china fir (*Cunninghamia lanceolata*) holds less bird species than the other forest types. The lamda values of cultivated forests were lower than the lamda value of hardwood forest. However, the evenness indices of community in cultivated forests were greater than the evenness index of community from hardwood forest. Dominant bird species was found in hardwood forest to influence the community structure. The species richness of avian community in Japanese cypress (*Chamaecyparis obtusa*) vegetation type was the greatest among the 6 different vegetation types. Guilds IB and FU were found highly selective for their habitats among different vegetation types. (A1 - Migration: 4/28 - 11:45)

64. PARTITIONING VARIANCE IN SURVIVORSHIP AMONG DIFFERENT PHASES OF THE ANNUAL CYCLE OF A NEOTROPICAL MIGRANT SONGBIRD. T. SCOTT SILLETT* and RICHARD T. HOLMES, Department of Biological Sciences, Dartmouth College, Hanover, NH.

One of the most studied and publicized conservation problems in North America is the decline of forest-dwelling, migratory songbirds. However, few studies have documented these species' survival rates. Furthermore, we do not know how mortality varies among seasons for any migratory songbird. In this study, we used capture-recapture models for open populations to analyze survivorship patterns of Black-throated Blue Warblers (*Dendroica caerulescens*) at five intervals during the annual cycle: 1) annually from May-May for a breeding population in New Hampshire USA; 2) annually from October-October for a wintering population in Jamaica; 3) overwinter in Jamaica from October-March; 4) from March-October in Jamaica, encompassing the migration and breeding periods; and 5) oversummer in New Hampshire from May-August. Data were based on resightings of color-banded individuals from 1986-1998. Annual survivorship averaged 60% for both populations, and there were no significant differences in survival due to sex or age. Annual survivorship estimates differed strongly among years in Jamaica (October-October), primarily due to interannual variation in survival during the October March interval. Annual survivorship was relatively constant in New Hampshire (May-May). Overwinter survivorship (March-October in Jamaica) averaged 85% and oversummer survivorship (May-August in New Hampshire) averaged 95%, with no significant sex or age differences for either interval. Using these data, we inferred that survival rates were 74% for the two migratory periods combined. This study provides the first estimates of how survivorship of a migratory songbird varies among phases of the annual cycle. In conjunction with ongoing demographic modeling efforts, these data will enhance our knowledge about the relative impacts of the breeding, migration, and non-breeding periods on songbird population dynamics. (C2 - Population Ecology, Climate, and Season: 4/29 - 11:30)

65. ***TERRITORIAL DYNAMICS AND SPATIAL UTILIZATION OF A FRAGMENTED HABITAT BY COASTAL CACTUS WRENS**. CHRISTOPHER W. SOLEK, Biological Sciences Department, California State Polytechnic University, Pomona, CA 91768

Coastal Cactus Wrens (*Campylorhynchus brunneicapillus*), restricted to the Pacific slope of southern California and northern Baja California, represent a disjunct population of a widely distributed and relatively common desert-inhabiting species found throughout the U.S. desert southwest, Baja California and portions of mainland Mexico. Coastal populations are unique in that they are obligate inhabitants of Coastal Sage Scrub, a vegetation community confined to the mediterranean-climate zone in North America. Ecological information on these populations is limited. This study focuses on a discrete coastal population in eastern Los Angeles County, California and investigates the role that habitat plays in shaping territorial dynamics and behavior. I am investigating how territory size is correlated with both Cactus Wren behavior and various vegetation and landscape characteristics. I am also interested in describing the variability among individual territories in regards to size, shape, placement, and vegetation structure, documenting changes in territorial configurations over the course a year, and discerning whether some territories are preferable to others due to unique combinations of vegetation and landscape features. Information of this type, especially as it relates to the spatial aspects of habitat utilization, foraging behavior, and habitat preference, will be particularly useful in developing future management plans for coastal populations of the Cactus Wren. My current research involves delineation and mapping of individual territories, behavioral observation, and vegetation characterization of the habitat. Application of Geographic Information System (GIS) software, primarily ArcView and ARC/INFOâ , and digital mapping techniques in conjunction with the field work will provide a method of quantitatively describing cactus wren habitat and the effects of small-scale fragmentation on territorial behavior. This synthesis of ground-truthed and digital information will assist me in answering my specific ecological questions about the species.

66. ***INTERHEMISPHERIC COLONIZATION AND PHYLOGENETIC RELATIONSHIPS IN THE AVIAN FAMILY BOMBYCILLIDAE**. *GARTH M. SPELLMAN, Department of Biology and Wildlife & University of Alaska Museum, University of Alaska, Fairbanks, AK; KEVIN S. WINKER, University of Alaska Museum & Department of Biology and Wildlife, University of Alaska, Fairbanks, AK.

The distributions of the Bombycillidae and their allies are ideal for phylogenetic reconstruction of intercontinental colonization between North America and Eurasia. In this study, we generated a phylogeny of all three species of Bombycillidae (*Bombycilla cedrorum*, *B. garrulus*, and *B. japonica*) and their allies based on 1040 bp of mitochondrial cytochrome b sequence. There is strong support (99% bootstrap values) for the monophyly of the Bombycillidae and strong support for the New World endemic families Dulidae and Ptilogonatidae being their closest relatives. A mid to late Miocene (10.3 to 7.1 MYA) Neotropical origin for the Bombycillidae and a subsequent colonization of Eurasia via Beringia is inferred from the phylogeny. This may pose an exception to the normal pattern of faunal exchange between North America and Asia. Within the Bombycillidae, *B. cedrorum* is monophyletic (100% bootstrap values) and *B. garrulus* exhibits paraphyly with respect to B. japonica. The possible sources of paraphyly in mtDNA phylogenies are discussed and evaluated in relation to this case. (A2 - Systematics: 4/28 - 2:15)

67. *TESTOSTERONE AND REPRODUCTIVE TRADE-OFFS IN MALE HOUSE FINCHES, *ANDREW M. STOEHR, Department of Biology, University of California, Riverside, CA

Observations that monogamous and polygynous male birds differ not only in seasonal testosterone profiles but also in the allocation of reproductive efforts have led to the hypothesis that testosterone secretion is the proximate mechanism through which male birds balance trade-offs in reproductive effort. I tested this hypothesis in male house finches by experimentally manipulating testosterone levels and observing the effects of this treatment on male song rates, an index of mating effort, and nestling feeding rates, an index of parental effort. Consistent with the hypothesis, males with elevated testosterone showed increased song rates but decreased nestling feeding rates. However, females mated to experimental males increased their parental efforts to fully compensate for the reduced efforts of their mates, suggesting that the cost to males of decreased parental effort may be not be expressed in those nesting attempts. Interestingly, testosterone treatment also resulted in drab plumage in males given hormone implants late in the spring, possibly due to the effects of testosterone on molt. These behavioral and plumage-related effects may explain previous observations that drab male house finches are more aggressive and provide less parental care. (B3 - Physiology, Morphology, and Disease: 4/28 - 3:45)

68. NEST SITE AND MICROHABITAT USE BY ENDANGERED SOUTHWESTERN WILLOW FLYCATCHERS ON THE GILA RIVER, NEW MEXICO. *SCOTT H. STOLESON, U.S.D.A., Rocky Mountain Research Station, Albuquerque, NM; DEBORAH M. FINCH, U.S.D.A., Rocky Mountain Research Station, Albuquerque, NM.

The endangered Southwestern Willow Flycatcher (*Empidonax traillii extimus*) is a riparian obligate inhabiting dense streamside thickets and woodland. Its recovery will depend on a quantitative understanding of what constitutes preferred habitat, but this understanding has been hindered by great variation in floristics, vegetation structure, and the extent of human alteration of occupied habitats. We present information on nest site and microhabitat characteristics of Willow Flycatchers in the largest extant population of the subspecies along the upper Gila River in New Mexico. We compared the usage of different nest trees with their availability within occupied habitat to show that flycatchers disproportionately nested in boxelder, and significantly avoided willows; other trees were used in proportion to their abundance. We compared values of 19 habitat variables between nest sites and unused sites within occupied habitat. Compared to unused sites, microhabitat around flycatcher nest sites was characterized by significantly lower ground cover, greater and less variable canopy cover, lower canopy height, higher foliage density in the subcanopy, more heterogeneous foliage density, higher foliage height diversity, more stems of shrubs, trees, and boxelder, fewer cottonwood stems, greater proximity to water, and different species of herbaceous vegetation. A logistic regression model identified the principle differences as foliage density in the subcanopy, canopy cover, number of trees, and presence/absence of nettles (*Urtica dioica*). This quantitative assessment of Southwestern Willow Flycatcher habitat, indicating a preference for dense, structurally complex vegetation near water, corroborates qualitative descriptions from elsewhere within its range.

69. INFLUENCE OF ECOLOGICAL FACTORS ON THE WINTER DIET OF HERMIT THRUSHES. **CHERYL STRONG**, Dept. of Biology, Southeastern Louisiana University, Hammond, LA 70402.

Food availability has been linked to habitat selection in numerous studies. We studied this relationship in wintering Hermit Thrushes (*Catharus guttatus*) in southeastern Louisiana and tried to find the best ecological predictors of Hermit Thrush food choices. Fecal samples were examined to determine winter diet. Samples were identified as containing fruits, invertebrates, or both. Fecal samples were found to contain predominantly a combination of fruits and invertebrates, although contents did vary among habitats and time period when collected. Predictor variables were then used to classify Hermit Thrush diet selection using stepwise logistic regression. Weather variables, the presence of other competitors for food resources, habitat and time period were removed from the logistic regression as poor predictors of fecal sample contents. The only variable that was significant in determining fecal sample contents was the amount of fruits available within a Hermit Thrushes winter territory. This suggests that the presence of an abundant food resource, like fruit, can be important in determining habitat selection for over-wintering birds.

70. CORRELATION OF SUMMIT METABOLISM AND THERMOGENIC ENDURANCE IN WINTER ACCLIMATIZED PASSERINES. DAVID L. SWANSON, Department of Biology, University of South Dakota, Vermillion, SD.

Small birds exhibiting marked winter improvement of cold tolerance also show elevated summit metabolic rates (M_{sum} = maximum cold-induced metabolic rate) in winter relative to summer. However, relatively large increases in cold tolerance can occur with only minor increments of M_{sum}, and geographic variation in cold tolerance is not always positively correlated with M_{sum} variation. Thus, it is uncertain whether M_{sum} and cold tolerance are phenotypically correlated in small birds and no previous study has directly examined this relationship. I measured M_{sum} and cold tolerance (i.e., thermogenic endurance) over three winters in Black-capped Chickadees *Poecile atricapillus*, American Tree Sparrows *Spizella arborea*, and Dark-eyed Juncos *Junco hyemalis* from South Dakota. M_{sum} was measured by open-circuit respirometry during exposure of individual birds to a decreasing series of temperatures in a 79% helium/21% oxygen atmosphere. Significant positive correlations between log mass and log M_{sum} were obtained for chickadees and juncos ($P < 0.002$), but not for tree sparrows. Mass was significantly and positively correlated with thermogenic endurance only for juncos ($P = 0.025$). Residuals of M_{sum} and thermogenic endurance from mass regressions were significantly and positively correlated in juncos ($P < 0.001$) and tree sparrows ($P = 0.016$), and their correlation approached significance for chickadees ($P = 0.087$). Regression R^2s were 0.54 for juncos, 0.27 for tree sparrows, and 0.11 for chickadees. These data thus provide the first direct evidence for a phenotypic correlation between M_{sum} and thermogenic endurance in winter acclimatized small birds, although much of the variance in thermogenic endurance is explained by factors other than variation in M_{sum}. Thus, these data suggest that physiological adjustments producing elevated thermogenic endurance also result in elevated M_{sum} in small birds. (B3 - Physiology, Morphology, and Disease: 4/28 - 4:00)

71. ALTITUDINAL MIGRATION AND HABITAT USE BY DISPERSING, JUVENILE CALIFORNIA SPOTTED OWLS IN THE SOUTHERN SIERRA NEVADA, CALIFORNIA. ROBERT M. TIBSTRA, Department of Biology, California State University, Fresno, CA.

To adequately plan for the conservation of California spotted owls (*Strix occidentalis occidentalis*), it is necessary to study all aspects of the owl's life history. Natal dispersal, the movement of individuals from the areas where they begin life to the areas where they first breed, is one such characteristic. I studied first-year dispersal of 26 California spotted owls in the southern Sierra Nevada, California in 1991, 1992, 1997, and 1998, using radiotelemetry. Forty-five percent of 22 birds that hatched in high elevation, coniferous habitats migrated to low elevation, pine-oak woodlands during some phase of dispersal. Two of these birds' elevational movements showed a positive correlation with mean daily temperatures on the study area ($n = 68$, 63 locations, $P < 0.001$). Based upon availability on the study area as determined from aerial photographs, these birds used areas with > 70 % tree canopy closure more often than expected and areas with 0-19 % less often than expected. In addition, measurements of canopy closure at roost sites indicated that these birds roosted in areas with > 80 % cover ($n = 56$), using both the spherical densiometer and moosehorn methods. Dispersing juveniles appear to use habitat similar to adults in terms of canopy closure around roosts, and their movements may be significantly influenced by weather events. The pine-oak woodlands may be critically important to dispersing juveniles; however, additional long-term studies is necessary to clearly identify these patterns. (C3 - Habitat Relationships and Conservation: 4/29 - 2:45)

72. THE HUNTING AND NESTING SUCCESS OF NORTHERN HARRIER (*Circus cyaneus*) IN YELLOW STAR-THISTLE (*Centaurea solstitialis* L.) AT BEALE AIR FORCE BASE, CALIFORNIA. *NATASHA TUATO'O-BARTLEY, California State University, Sacramento, 6000 J Street, Sacramento, CA, 95819-6077; LINNEA S. HALL, 2552 Seahorse Ave, Ventura, CA 93001.

The Northern Harrier (*Circus cyaneus*), a grassland-using bird of prey, is a species of special concern in California, and since 1972 has been listed on the National Audubon Society's Blue List, which is an early warning list for species showing potentially serious population decline due to habitat loss. Yellow star-thistle (*Centaurea solstitalis*) has become a problem in the western United States where it has invaded large areas, but little is known about the effects of yellow star-thistle on wildlife. Northern Harriers have been observed hunting and nesting at Beale Air Force Base in areas infested with yellow star-thistle. To determine the potential impacts of yellow star-thistle on harriers, we studied the hunting success and nesting success of these bird in different gradients of yellow star-thistle at Beale AFB, California, from winter 1998-99 to winter 1999-2000. Hunting observations were made by using focal observations along a 33.6 km road transect on the base. Within each hunting observations area we recorded plant cover and plant height at two separate grids. In addition, to get an estimate of rodent prey abundance across different gradient of yellow star-thistle, we conducted trapping in areas highly used by harriers for hunting. During the breeding season, we documented 12 nest attempts at 5 different sites on the base. Three harrier nests successfully fledged 4 young; three additional nests were predated; four nests were apparently abandoned. Two of the nesting females re-nested. Ten of the nests contained yellow star-thistle around them ranging from 8.89 to 81.25 %, and average height of 38 cm. Hunting success of harriers showed variation around Beale AFB based on vegetation composition. Northern Harriers may select sites to hunt and nest where yellow star-thistle is present before it matures and grows thorns.

73. **VOCAL COMMUNICATION IN THE BREWER'S SPARROW.** *BRETT L. WALKER and ERICK P. GREENE, Division of Biological Sciences, University of Montana, Missoula, MT.

Knowing how conspecifics communicate is a critical part of understanding a species' breeding biology. Yet, in birds, most species' song repertoires, singing behaviors and typical patterns of song use (i.e., song systems) have yet to be described. Male Brewer's sparrows (*Spizella breweri*) are spectacular songsters of western sagebrush habitats, but little is known about their song system. Previous observations indicate that they use both "short-repeat" singing, consisting of individually distinctive short songs (2-4 sec) delivered with little or no variety (i.e., AAAAA... or rarely ABABA...), as well as "long-serial" singing, in which they sing long songs (5-30 sec) delivered with immediate variety (i.e., BCDEFGH...). I studied the song system of color-banded male Brewer's sparrows in eastern Washington in 1998 and 1999. I first documented individuals' singing behaviors in different stages of the breeding cycle and in different behavioral contexts. I then conducted short-term female removal, clutch removal and playback experiments designed to identify the specific cues that cause males to switch between singing behaviors. My data provide support for the idea that short-repeat singing is directed at other males and helps the singer establish and maintain territory boundaries via long-distance countersinging. Short-repeat singing is simultaneously used to inform prospective female mates about a male's pairing status and possibly also his genetic quality, territory quality or both. Long-serial singing by unpaired males signals elevated aggression toward intruding males. However, long-serial singing during the pre-dawn chorus and after pairing may be entirely separate singing behaviors - their function remains unknown. The pronounced similarity of the Brewer's sparrow's song system with that of many other temperate songbirds provides support for Morton's (1996) hypothesis that the length of the breeding season in temperate birds acts as a constraint on mating systems and drives convergence of male signaling strategies across species. Research into mechanisms of female choice, genetic mating systems, and the function of long-serial singing by paired males and during the pre-dawn chorus will most advance our understanding of Brewer's sparrow communication. (B1 - Song: 4/28 - 11:30)

74. **WHERE IS THE SOUTHERN RANGE LIMIT OF BREEDING "TIMBERLINE" SPARROWS?** *BRETT L. WALKER, SUZANNE A. COX, ERICK P. GREENE, Div. Biological Sciences, University of Montana, Missoula, MT; MELISSA M. HART, Wildlife Spatial Analysis Laboratory, University of Montana, Missoula, MT; STEVE J. GNIADEK, DAVID SHEA, Glacier National Park, West Glacier, MT; JOHN E. LUNDBLAD, Biology Department, Sonoma State University, Rohnert Park, CA.

Two closely-related taxa, the Brewer's sparrow (*Spizella breweri*) and the "Timberline" sparrow, *Spizella* [*breweri*] *taverneri*, may soon be reinstated as separate species. Although Timberline sparrows have been suspected to breed in the northwestern U.S. for decades, systematic survey efforts have never been conducted. Accordingly, we surveyed for Timberline sparrows along the east front of the Rocky Mountains in Montana's Glacier National Park in 1998 and 1999. Over 200 pairs were found at 26 survey locations within Glacier, with breeding confirmed at 11 locations. Their abundance near the southern park boundary suggested that they might also occur in surrounding areas. We developed a GIS model to predict Timberline sparrow habitat south and west of the park. Although the model was poor at predicting Timberline sparrow presence (<10%), we nonetheless discovered over 30 pairs at 5 new sites in the Lewis and Clark National Forest (LCNF). Breeding was confirmed at the southernmost LCNF site, thereby extending their known breeding range by over 150 kilometers to the south. The combination of habitat use, timing of breeding, plumage, morphology, and vocalizations indicate that Glacier birds are indeed taverneri rather than breweri, but the phylogenetic affinities of LCNF populations are still in doubt and currently under investigation using molecular genetic techniques. In Montana, Timberline sparrows nest in areas with patchy krummholz shrubs, primarily subalpine fir, willow, and Douglas-fir. Almost all territorial males were on open, east-, south-, or west-facing slopes at treeline, indicating that temperature or duration of snowpack may ultimately influence local settlement patterns. Interspecific competition with White-crowned sparrows or Dark-eyed Juncos may also restrict habitat use within a location. The southern limit of their distribution remains unknown, but probably depends, in part, on the availability of krummholz vegetation suitable for nesting.

75. **THERMAL CONDUCTANCE AND ENERGETICS OF HIGH-LATITUDE SEABIRDS**. *W.W. WEATHERS, K.L. GERHART, and P.J. HODUM, Avian Science Department, University of California, Davis, CA.

Whether high-latitude seabirds (breeding latitude 54-79o) possess mitigating adaptations to their cold environment, such as enhanced insulation, is unknown. To examine the thermal conductance of high-latitude seabirds, we compared literature values with allometric predictions and measured resting metabolic rates at air temperatures between ca. -5 and 30oC in adults and 7 age classes of nestling Antarctic fulmarine petrels. Two of the four species, the snow petrel (*Pagodroma nivea*) and the Antarctic petrel (*Thalassocia antarctica*), share the distinction of being the most southerly nesting birds. They regularly encounter temperatures below 0oC when breeding, and occasionally as low as -25oC. The other two species, the cape petrel (*Daption capense*) and Antarctic fulmar (*Fulmarus glacialoides*) have somewhat more northerly distributions in Antarctica. Basal metabolic rate (BMR) and thermal conductance of adult fulmarine petrels averaged, respectively, 140% and 100% of values predicted allometrically for nonpasserine birds. Minimum metabolic rates of unfasted nestlings aged 15-42 days averaged, respectively, 97 and 98% of predicted adult BMR in Antarctic petrels and snow petrels versus 119% and 126% of predicted in Antarctic fulmars and cape petrels. Nestlings of the more southerly breeding snow petrel and Antarctic petrel were relatively well insulated compared with nestlings of other high-latitude seabirds. Adult lower critical temperature was inversely related to body mass and differed by < 2oC from that predicted allometrically. Lower critical temperature declined with age from 14 to 22oC in 3-day-old nestlings, reached a minimum at maximal nestling mass, and then increased with weight recession. Nestling lower critical temperature was close to mean air temperature from the end of brooding until fledging in the three surface nesting species. Thermal conductance of 15 species of high-latitude seabirds (including those we studied) averaged 90% of predicted (range 70-142%). In four species weighing <160 g, conductance was 25-30% lower than predicted. Small seabirds from high latitudes thus seem well insulated, but the conductance of many larger species is unremarkable.

76. **THE INFLUENCE OF HABITAT AND DISTURBANCE ON BURROWING OWL REPRODUCTIVE PERFORMANCE**. *JASON D. WOODARD, Graduate Degree Program In Ecology, Colorado State University, Fort Collins, CO; BEATRICE VAN HORNE, Department of Biology, Colorado State University, Fort Collins, CO.

We examined the influence of habitat and disturbance on the reproductive output of burrowing owls (*Speotyto cunicularia*) in northeastern Colorado. Our primary objective was to describe the effect of recreational shooting and landscape heterogeneity on two measures of reproductive output, nesting success and number of young fledged. We observed 102 nesting attempts occurring on 23 active black-tailed prairie dog (*Cynomus ludovicianus*) colonies located in the western and southeastern regions of the Pawnee National Grassland, Weld County, Colorado (400 49' N, 1040 46' W). Mean nesting success was 62.8% (N = 86). Successful nests fledged an average of 2.21 young (N = 29, SD = 1.24). Twenty-five nests were excluded from productivity analyses to eliminate bias associated with the inclusion of late season successful pairs. Reproductive estimates were not correlated with the size of a colony, the number of nesting pairs/hectare (nesting density), or the distance to the nearest nesting neighbor. Preliminary analyses, however, suggest that recreational shooting affects burrowing owl reproductive performance. Burrowing owls nesting on the Central Plains Experimental Range (CPER), an area with shooting restrictions, were more successful and produced more fledglings than owls nesting on public lands where recreational shooting is permitted. Nesting success and productivity also are affected by land use. We describe the influence of land use, patch diversity, patch proximity, and edge using GIS approaches (FRAGSTATS).

77. **ARE THERE SNAGS IN THE SYSTEM? WOODPECKERS AND THE COMPLEXITIES OF PINE DECAY THAT AFFECT "SNAGS PER ACRE" MANAGEMENT**. *STEVE ZACK, Wildlife Conservation Society, Portland, OR; T. LUKE GEORGE, Department of Wildlife, Humboldt State University, Arcata, CA; PATRICK J. SHEA, USDA USFS-PSW, Davis, CA; WILLIAM F. LAUDENSLAYER, JR., USDA USFS-PSW, Fresno, CA.

We have been studying the biology of Ponderosa Pine decay and the "demography" of snags as they relate to managing cavity-dependent bird species. These issues are complex, and we argue that providing necessary "snags-per-acre" prescriptions requires more emphasis on biological processes than on providing minimal numbers of dead trees. Here we attempt to tease apart some of this complexity. Changes in Eastside pine forests over the past century involve logging, fire suppression, grazing and climate change. Forests of today are denser, with fewer large trees. Densities of cavity-nesting birds differ on two of our sites, likely as a function of the presence of large trees (and snags). Cavities in pine snags occur in the sapwood, thus sapwood decay is an essential part of the process if cavities are to be excavated. Only ca. 20% of snags on our sites have cavities. Woodpeckers (primarily *Picoides spp.* (see also paper by Hughes et al.)) foraging on bark beetle infestation seem to be associated with decay histories that lead to cavity generation, suggesting that these interactions may lead to sapwood invasion by sapwood fungi. Separate experiments, contrasting the decay process via girdling vs. bark beetle response to pheromone baited trees, reveals that the arthropod and woodpecker response to baited trees is much greater than that on girdled trees. Cavity excavation has only been detected on experimentally baited trees, none yet on girdled trees. We argue that woodpeckers not only excavate cavities, but their foraging on the early portion of the decay process is correlated with those processes (bark beetle activity and sapwood fungal decay) that create the possibility of cavity generation. We will not present a model to explain this complexity! But we will argue that estimating simply a number of "snags-per-ace" is insufficient to manage wildlife in forests. (C4 - Habitat Relationships and Conservation: 4/29 - 4:15)

78. ***NEST SITE SELECTION BY FORSTER'S TERNS** (*Sterna forsteri*). ROBIN E. DAKIN, San Francisco Bay Bird Observatory, Alviso, CA

I compared nest site microhabitat characteristics of Forster's Terns (*Sterna forsteri*) to randomly chosen sites within three colonies in south San Francisco Bay to show whether birds selected certain nest site characteristics, and evaluated the effect of these nest site characteristics on reproductive success. In addition, I evaluated differences in habitat characteristics of the three colonies. Forster's Terns selected nest sites with vegetation cover when vegetation was available and nest sites within 0.4 m of a wall. There was a negative correlation between reproductive success and the number of neighbors within 2 m. Forster's Terns use topography as cover from predation and extreme weather conditions. Significant differences were found between habitat characteristics of the three colony sites. Decreased nest success with increased nest density could have been due in part to an artifact or a density dependant factor such as increased visibility to predators.

1. **COMMON RAVENS AS SUBSIDIZED PREDATORS.** WILLIAM I. BOARMAN, U.S. Geological Survey, Department of Biology, University of California, Riverside, Riverside, CA

Subsidized predators are species whose populations survive and often thrive on resources (e.g., food, water, safety, etc.) provided by humans. Common ravens (*Corvus corax*) are an excellent example of a subsidized predator. Their populations have grown precipitously in recent years as a result of the proliferation of human activities in the desert. In a multi-year survey, significantly more ravens were found at landfills and sewage ponds than at other human-dominated and natural areas. Radio-tagged ravens primarily moved between anthropogenic resource sites. Nestling and fledgling survivorship is higher in nests located near human-provided resources. Ravens prey on juvenile desert tortoises (*Gopherus agassizii*), a Federally-listed threatened species, over much of the tortoises' range. However, not all ravens prey on tortoises, and few appear to prey on them in large numbers. It is not known if raven predation is high enough to prevent tortoise recovery rangewide, but it is likely high enough in some areas to alter success of recovery efforts. Removal of selected ravens known to prey on tortoises will likely aid short-term recovery in some areas, but such efforts should be coupled with aggressive reductions in anthropogenic resources (e.g., garbage) made available to ravens. (2:30)

2. **DEVELOPMENT OF A CORVID MANAGEMENT PLAN FOR CALIFORNIA.** *ESTHER E. BURKETT, California Department of Fish and Game, Habitat Conservation Planning Branch, Sacramento, CA.

The California Department of Fish and Game is in the process of preparing " A Corvid Management Plan for California", in cooperation with the U.S. Fish and Wildlife Service. Information will be compiled on corvid impacts to threatened and endangered species, as well as other native California wildlife. The document will include management recommendations to lessen the impact of these opportunistic predators and assure conservation of native wildlife. It will include basic life history and habitat requirements of three primary corvid predators: Common Raven, American Crow, and Steller's Jay. Existing data sets, and published and unpublished information will be complied to more fully document corvid increases in the state. The long term goal is to increase populations of threatened and endangered species, while maintaining corvid populations at lower levels, as probably existed prior to human supplemental food sources. The plan will seek to avoid or minimize any direct trapping and removal of predators, and instead will address problems directly at the source (landfills, artificial feeding, dairies, inadequate garbage management, etc.). Where feasible, populations of threatened and endangered wildlife will be monitored for beneficial effects of the plan. Cooperation is needed from corvid researchers to assure this document contains all pertinent information. We would welcome partners in this endeavor.

3. **EVOLUTIONARY GENETICS OF CORVUS: MORE THAN MEETS THE EYE.** *ROBERT FLEISCHER, KEVIN OMLAND, CARL MCINTOSH, National Zoological Park, Smithsonian Institution, Washington, DC 20008; CHERYL TARR, Department of Biology, Pennsylvania State University, State College, PA; WILLIAM BOARMAN, USGS, UC Riverside, Riverside, CA 92521; FERN DUVALL, Hawaii DLNR-Department of Forestry and Wildlife, Maui, HI; JOHN MARZLUFF, Department of Ecosystem Sciences, University of Washington, Seattle, WA 98195.

The genus Corvus has a wide geographic distribution, encompassing arctic, temperate and tropical regions in the Old and New Worlds. Some species within the genus are widespread and have increasing populations that potentially represent conservation threats (e.g., Common Raven impacts on desert tortoise), while other Corvus are single island endemics and critically endangered (e.g., Hawaiian Crow). This paper provides an assessment of the phylogenetic relationships of a portion of the genus, and assesses phylogeography and genetic variability within a few of the species. Comparisons are made between patterns and levels of variation in a geographically widespread species and two island endemics. We also compare present-day genetic variability within the endangered Hawaiian Crow with the levels that existed prior to their major population decline. (9:30)

4. **MORTALITY IN THE AMERICAN CROW ATTRIBUTED TO WEST NILE VIRUS.** *LINDA C. GLASER, USGS National Wildlife Health Center, Madison, WI; WARD STONE, New York Department of Environmental Conservation, Albany, NY; ROBERT G. MCLEAN, LOU SILEO, DOUGLAS E. DOCHERTY, and WALLACE HANSEN, USGS National Wildlife Health Center, Madison, WI

In the summer and fall of 1999, an outbreak of West Nile virus (WNV) occurred for the first time in the Western Hemisphere in the New York City area. West Nile virus is an arthropod-borne virus with birds as the natural hosts and is transmitted from infected birds to humans and other animals through bites of infected mosquitoes. Although WNV generally causes a mild disease in humans, it can cause severe illness and death, especially in the elderly. Seven out of 62 clinically ill people died during the 1999 New York City outbreak. An increase in reports to state wildlife professionals of sick and dead crows was associated with the human outbreak. Live crows infected with WNV exhibited neurological signs including tremors, loss of coordination, inability to fly, and more severe signs of inability to stand or seizures. Both American crows (*Corvus brachyrhynchos*) and fish crows (*C. ossifragus*) appear to be highly susceptible to this virus. West Nile virus positive crows were used to identify the presence of the virus in a local area assisting state and local health departments in determining the risk to humans. During the outbreak period of August to November of 1999, thousands of crows are estimated to have died from WNV in the New York City area which includes southwestern Connecticut and northeastern New Jersey. Passive surveillance utilizing dead crows as an indicator species was established in the Atlantic coastal states to track the possible expansion of the virus out of the NYC area. The American crow is an ideal species for this purpose as they are widely distributed in this geographic area in urban, suburban, rural, and wilderness habitats. They are a relatively local species, especially during the nesting and fledging time of year when WNV activity is being monitored; a positive WNV crow found at this time of year is a bird with a locally acquired infection. Crows are also a conspicuous species and thus sick and dead birds are more easily observed and found. West Nile virus was found in 17 other North American bird species although it is unknown whether all of these birds died from the virus. There is concern that the spread of WNV virus may impact common raven populations in the northeast; a state endangered species in New York. (11:30)

5. **RAVEN INTELLIGENCE TESTS**. BERND HEINRICH, Department of Zoology, University of Vermont, Burlington, VT

Among corvids, ravens (*Corvus corax*) are presumed to rank high in intelligence. However, intelligence is often difficult to test, to define and to interpret. I shall compare several aspects of raven behavior that may relate to intelligence in the context of evolved responses under the selective pressure of constraints. Behavioral flexibility as well as apparent inflexibility will be discussed in terms of recognition, finding, accessing and manipulation of food. (10:00)

6. **PATTERNS OF REPRODUCTIVE OUTPUT IN COMMON RAVENS (*Corvus corax*) RELATIVE TO ANTROPOGENIC RESOURCES IN THE WEST MOJAVE DESERT**. WILLIAM B. KRISTAN III, University of California, Riverside, CA and WILLIAM I. BOARMAN, U.S.G.S. Biological Resources Division.

Common Ravens are relatively recent additions to the Mojave desert. Raven population increases are putatively due to the changes in resource availability caused by human activities. We are studying the effects of these resources (particularly food and water) upon the spatial distribution and productivity of ravens at Edwards Air Force Base, and areas surrounding the base. Preliminary analyses of nesting data for 1996-1999 show that ravens nest in higher densities and are more productive near housing developments, landfills, sewage ponds, and other human-provided sources of food and water than they are in undeveloped areas. Additionally, the relatively stable resource levels in developed areas appear to damp the variation in productivity among years compared with undeveloped areas. Ravens have been implicated as important predators on juvenile desert tortoise (*Gopherus agassizii*), and other small vertebrates and invertebrates. Although the ravens nesting in undeveloped areas may be the least productive, they are likely to have the greatest impact on the native fauna, suggesting that efforts to minimize raven impacts on these species may require a regional approach.

7. **EVEN CROWS FIND ISLAND LIFE CHALLENGING.** *JOHN M. MARZLUFF, College of Forest Resources, University of Washington, Seattle, WA; SCOTT R. DERRICKSON, National Zoological Park, Front Royal, VA.

Crows are among the birds most successful at adjusting to human disturbance. In fact, they often thrive on the very disturbance (urbanization, habitat fragmentation) that is responsible for the majority of avian endangerment. However, the Hawaiian Crow (*Corvus hawaiiensis*) and the Mariana Crow (*Corvus kubaryi*) are among the rarest birds in the world. The Hawaiian Crow in particular is well down the abyss of the extinction vortex (currently 3 birds remain in the wild on 1 island; 26 reside in captivity). The Mariana Crow population is thought to number less than 500 and is "secure" only on the island of Rota, Commonwealth of the Northern Marianas. Reasons for endangerment in both species are familiar, but varied (exotic predators, exotic diseases, habitat reduction). Small geographic range resulting from island life likely predisposed both species to endangerment. Efforts are currently underway to breed both species in captivity and reintroduce them back into historical habitat. We describe the successes, failures and remaining challenges to these restoration efforts. Three challenges loom particularly large: (1) removing the threat of varied and extremely successful exotic predators (brown tree snakes on Guam) and diseases (toxoplasmosis on Hawaii), (2) overcoming political obstacles that reduce funding for island conservation in general, and (3) engendering the support of all stakeholders for reintroduction. The relative importance of conserving multiple, isolated populations of critically endangered species is illustrated by the relatively greater current security of the Mariana Crow (exists in 2 populations) compared to the Hawaiian Crow (1 population). Lastly, we compare demographic parameters of declining crow populations with those of exploding mainland crow populations to illustrate the ease with which even long-lived, prolific breeders can become threatened with extinction. (11:00)

8. **RESPONSES OF CROWS AND RAVENS TO HUMAN SETTLEMENT AND RECREATION: ARE CORVIDS HARBINGERS OF DEATH OR AGENTS OF DESTRUCTION?** JOHN M. MARZLUFF, College of Forest Resources, University of Washington, Seattle, WA; *ERIK A. NEATHERLIN, College of Forest Resources, University of Washington, Seattle, WA.

Corvids have increased in many parts of the world in response to increased human activity. In western Washington, human populations are increasing rapidly which was hypothesized to juxtapose increasing corvid populations with forest-dependent endangered species. We tested this hypothesis from 1995-1999 on the Olympic Peninsula by surveying corvids, monitoring their demography, and assessing their role as nest predators on the threatened Marbled Murrelet (*Brachyramphus marmoratus*). American Crows (*Corvus brachyrhynchos*) increased abundance in response to human settlement and recreation. This was accomplished by a reduction in crow home range size allowing them to attain higher densities near humans. Crow fecundity and survivorship was unaffected by proximity to humans on the Olympic Peninsula. In contrast, Common Raven (*Corvus corax*) abundance was not significantly increased by proximity to humans. Ravens appeared unable to compress home ranges enough to allow density to increase near humans. Ravens capitalized on human food resources, but this appeared to be an ephemeral, rather than sustained, population response. Neither crows nor ravens were major nest predators on simulated murrelet nests. Thus, even though crows respond positively to human activity, the diversity of nest predators in an area makes generalizations linking crow numbers to levels of predation difficult. Crows and ravens appear to be indicators of landscape-level activities that increase predation rates rather than the actual mechanism for increased predation. In this way they are continuing their historical role as harbingers of death rather than agents of destruction. (2:00)

9. **A REVIEW OF THE EXPANSION OF RANGE OF THE HOUSE CROW *Corvus splendens*, THE IMPACTS OF ITS COLONISATION AND STRATEGIES USED IN ITS CONTROL**. COLIN RYALL, School of Environmental Management, Farnborough College, Hampshire, UK

Together, the five races of the House Crow *Corvus splendens* occupy a native range stretching from Southern Iran in the west to South Yunnan in the east, and throughout the Indian Subcontinent from Nepal to Sri Lanka. Over the past century, their range has increased dramatically and they have now colonized many sites bordering the Red Sea, Indian Oceans and its islands. They have also reached Australia, USA, Chile and Ireland, but have not so far established. It is clear that this dispersal process is continuing, as *C. splendens* has recently reached the Netherlands and Sumatra. The predominant mechanism of dispersal is ship-borne spread, although there have also been deliberate releases. A versatile and gregarious human commensal, *Corvus splendens* feed on refuse supplemented by stolen food, crops, young domestic fowl, nest-raiding, predation of small animals and kleptoparasitism, and they have achieved high population densities at most introduced sites. Although primarily an urban species, they disperse in groups to forage in countryside and along the seashore near to settlements. The species has become a pest throughout its introduced range and even in parts where it is native, as a crop raider, public nuisance and potential health risk. Of particular concern is their impact on the native avifauna; high intensity nest-raiding, particularly of colonial species, and harassment of larger species resulting in declining numbers. Control programs have mostly met with short lasted success, due primarily to lack of resources. A range of effective strategies are available and, given the will and adequate financial support, population levels can be reduced substantially through an integrated approach. Trapping has been employed with some success as a long term management strategy in Malaysia and East Africa. However, of crucial importance now is international action to prevent further ship-borne spread of *Corvus splendens*. (1:30)

10. **THE RAVEN IN TENNESSEE: A THREATENED SPECIES**. ALLAN TRENTLY, Department of Biology, East Tennessee State University, Johnson City, TN Department of Biology, East Tennessee State University, Johnson City, TN

The major purpose of this study was to determine nesting, and distribution of the Common Raven (*Corvus corax*) in Tennessee. Nests were located to gain insight into density, nesting activity, nest site habitat, home range, and nest spacing. This information was compared and contrasted to previous studies. The Common Raven was designated as Threatened in Tennessee by the Tennessee Wildlife Resources Agency (TWRA). Information gained by this study can be used by TWRA as baseline information for a proposed reintroduction of the raven into the Cumberland Mountains and Plateau of Tennessee.

11. **RAVEN JUVENILE SURVIVAL IN A HUMAN AUGMENTED LANDSCAPE** WILLIAM C. WEBB* Department of Biology, University of California, Riverside, CA; WILLIAM I. BOARMAN U.S.G.S. Western Ecological Research Center and Department of Biology University of California, Riverside, CA.

The Common Raven (*Corvus corax*) is known to form commensal relationships with other species that lead them to food including humans. Annual surveys in the western Mojave desert have shown a dramatic increased in raven sightings during the past 30 years. The apparent population increase coincides with an increasing human presence in the region and represents an ecological concern because ravens have been implicated in the decline of several threatened and endangered species, most notably the Desert Tortoise (*Gopherus agassizii*). In the western Mojave, ravens utilize resources obtained from human sources such as landfills, dairy farms, refuse dumpsters, and landscape runoff. We investigated the survival rate of juvenile ravens in relation to the degree of available anthropogenic resources in proximity to their nests. The survival rate was examined for the period between fledging and dispersal from parental territories. 112 ravens from 43 nests were marked as nestlings with patagial tags, 50 of which were also equipped with radio transmitters. After marking, raven juveniles were relocated 1-3 times per week until dispersing from parental territories. Linear distances were used to quantify the available anthropogenic resources in

proximity to each nest.. The best-fitting logistic regression model includes distance from the nearest anthropogenic resource as a significant predictor of juvenile survival. Our observations support the hypothesis that a regional increase in raven numbers results from increased juvenile survival rates generated by utilization of anthropogenic resources.

1. **INTRODUCTION—A BRIEF HISTORY OF THE SALTON SEA.** *MICHAEL A. PATTEN, Department of Biology, University of California, Riverside, CA; KATHY C. MOLINA, Section of Vertebrates, Natural History Museum of Los Angeles County, Los Angeles, CA; W. DAVID SHUFORD, Point Reyes Bird Observatory, Stinson Beach, CA.

   No abstract.

2. **HISTORY OF ORNITHOLOGICAL EXPLORATION OF THE SALTON SINK.** *KIMBALL L. GARRETT and KATHY C. MOLINA, Section of Vertebrates, Natural History Museum of Los Angeles County, Los Angeles, CA; MICHAEL A. PATTEN, Department of Biology, University of California, Riverside, CA.

   Ornithological exploration of the Salton Sink began prior to the formation of the present-day Salton Sea with collecting efforts by Mearns and Holzner, Nelson and Goldman, Stephens and others from 1894 to 1905. The first exploration of the sea itself was reported by Joseph Grinnell in 1908. Additional studies by Dawson, van Rossem, L. Miller, Pemberton, and others helped establish the uniqueness of the sea's avifauna; significant egg collections were also made in these early years. Among new taxa described from the Salton Sink, *Butorides virescens anthonyi* is based on a Mearns specimen from 1894, *Melospiza melodia saltonis* on Grinnell's 1908 collection, and *Geochelidon* [=*Sterna*] *nilotica vanrossemi* on birds taken by Pemberton and described by Bancroft in 1929. B. and M. Clary published several distributional records in the 1930s and important collections were made by E. A. Cardiff in the 1950s and 1960s. A fuller understanding of the diversity of birds using the Salton Sink, including an array of post-breeding visitors from the subtropics, developed with work by serious amateur field ornithologists, notably G. McCaskie, beginning around 1960–1965 and continuing to the present. Also, from the 1950s to the present, birds breeding in the thermally-challenging Salton Sea environment have served as subjects for research on avian physiological ecology and behavioral adaptations. The Salton Sea National Wildlife Refuge has maintained files on the avifauna of the region since the 1930s; agency census and management work has concentrated on harvestable waterfowl, but since the 1970s research has expanded to non-game species, including listed species such as the Yuma Clapper Rail. The role of the Salton Sink in the migration ecology of shorebirds, grebes, Ruddy Ducks and pelicans has received considerable recent study, as have breeding colonial waterbirds and Burrowing Owls. Present day research is largely focused on baseline data and predicted effects of various proposed remedial actions to stabilize the Sea.

3. **A BIRD'S-EYE VIEW OF AVIAN HABITATS AT THE SALTON SEA.** * TIMOTHY P. KRANTZ and STEVE HOOVER, Salton Sea Database Program, Center for Environmental Management, University of Redlands, Redlands, CA.

   Using visual simulations and geographic information system (GIS) technology, the audience will view the Salton Sea as seen from space, zooming in to take closer looks at the rich avian resources and significant habitats of the area. We will visually display and discuss the potential impacts of restoration project alternatives on avian habitats, including potential impacts of the "No Action" alternative, with possible reductions of inflow to the Sea as a result of water transfers or other reductions of allocations from the Colorado River.

4. **MIGRATION OF LANDBIRDS THROUGH DESERT RIPARIAN HABITATS OF THE SALTON SEA AND ITS ENVIRONS.** *SUSAN L. GUERS, MAUREEN E. FLANNERY, GEOFFREY R. GEUPEL, and NADAV NUR, Point Reyes Bird Observatory, Stinson Beach, CA.

Waterbird and shorebird use of the Salton Sea has been studied in detail, however there is limited and mostly anecdotal information on landbird migration through the area. In 1999, the Point Reyes Bird Observatory systematically surveyed landbirds at the Salton Sea to determine the use of its desert riparian habitats as migratory stopover sites. Using constant-effort mist-netting, point count surveys, and area search surveys, we assessed the diversity and abundance of birds in these habitats. During spring we surveyed four riparian sites along the north, south and eastern shores of the Sea. In fall we surveyed five riparian sites and one residential site all on the eastern shore of the Sea. Using constant-effort mist-netting, we caught a total of 1,542 individuals of 47 species at overall rates of 137.1 and 345.3 birds per 100 net hours in April and May, respectively. Less than 1% of the birds we caught were hatch year birds. During fall, we caught a total of 892 individuals of 49 species at overall rates of 73.4 and 64.6 birds per 100 net hours in September and October, respectively. Hatch year birds accounted for 45% of all total captures. We evaluated the use of the area during migration by comparing it to other banding and survey locations throughout the West. During spring, we caught Wilson's Warblers at an overall rate of 82.8 birds per 100 net hours, which accounted for 39% of all captures. More Wilson's Warblers were caught at the Salton Sea during spring migration than at any other mist-netting site in California. The abundance of neotropical migrants recorded during spring and fall, provides evidence that the area is used extensively by migrating passerines, including 11 species of statewide concern in riparian habitats. The high use of the Salton Sea and its environs by landbirds during migration suggests the need for effective management and restoration of desert riparian habitats.

5. **WINTER RELATIVE ABUNDANCE AND SPATIAL USE OF THE SALTON SEA BY SELECTED WATERBIRDS.** ROBERT L. MCKERNAN, Biology Section, San Bernardino County Museum, Redlands, CA; JOSEPH R. JEHL, JR., Hubbs-Sea World Research Institute, San Diego, CA.

The Salton Sea is the largest inland lake in California. It has long been postulated to be an important wintering and staging area for waterbird species. Between 1984 and 1999 we conducted a series of aerial surveys (>60 flights) of the entire Salton Sea monthly between October to March. Selected waterbird species were estimated monthly to determine winter relative abundance and spatial use of the Salton Sea. Primary species reported on are Eared Grebe, Western and Clark's Grebe, American White Pelican, Double-crested Cormorant, and Ruddy Duck. The monthly and yearly count results over the fifteen-year period confirms that this hypersaline lake is an major wintering and staging location for selected waterbirds. The yearly relative abundance and yearly trends for the Eared Grebe, Western and Clark's Grebes, Double-crested Cormorant, American White Pelican and Ruddy Duck indicate that greater than 1.5 million birds of these combine species can overwinter on the Salton Sea. For all counts the sea was divided into six areas; river inflows, four inshore areas and the offshore zone. Among specific sites, utilization by Eared Grebes and Ruddy Ducks were correlated with specific inshore areas and the offshore zone during certain months and among years ($P < 0.05$). And most American White Pelicans and Double Crested Cormorants used river inflow areas exclusively monthly as well as among years. The spatial and temporal use of the sea for selected waterbirds based on our results indicate that certain areas of the Salton Sea are utilized significantly more during certain months and among years. Over the fifteen-year period these count data indicate that the Salton Sea is an important wintering and staging area for selected waterbirds in the western United States.

6. **WATERBIRDS AND WETLAND CONSERVATION IN THE COLORADO RIVER DELTA, MEXICO.** *OSVEL HINOJOSA-HUERTA, School of Renewable Natural Resources. University of Arizona. Tucson, AZ; CARLOS VALDES-CASILLAS, Center for Conservation of Natural Resources (CECARENA), ITESM Campus Guaymas, Sonora, Mexico; STEPHAN DESTEFANO, Massachusetts Cooperative Fish and Wildlife Research Unit, University of Massachusetts, Amherst, MA.

The Colorado River delta has long been recognized as an important area for wildlife. Even today, after the vast reduction and modification of this ecosystem, about 60,000 ha of remnant wetlands support a diversity of species. A key element in the delta restoration process and a goal of our research and monitoring efforts is to understand the effects that habitat alteration and resource management have on wildlife populations in this area. This is an on-going project, of which partial results from March 1999 to February 2000 are presented. The purpose of this research is to correlate distribution and abundance of waterbirds with available habitats and resource use practices in the delta. Presence of waterbirds in these wetlands has been documented for 101 species from 17 families. Delta wetlands are used by at least 30 waterbird species as breeding sites, and by 73 species as wintering grounds or migratory stopovers. Nine endangered or threatened bird species occur in this area. Shorebirds and waders are the most diverse and abundant group, followed by colonial nesters, waterfowl, and marshbirds. Important areas for waterbirds include the Cienega de Santa Clara, Hardy River, Colorado Riparian Corridor, Laguna Salada, and Intertidal Wetlands. The main impact on waterbirds has been drastic wetland loss caused by water management practices. In comparison, activities of local communities have much less of an effect, except for flood control practices, which include stream canalization, closing of secondary streams, and vegetation clearing. Environmentally sound strategies should be pursued for flood control and river management, with a strong emphasis on a bi-national and ecosystem approach for wetland conservation as a critical component within the Pacific Flyway.

7. **TRACE ELEMENT AND ORGANOCHLORINE CONTAMINATION IN PREY AND HABITAT OF THE YUMA CLAPPER RAIL IN IMPERIAL VALLEY.** CAROL A. ROBERTS, U.S. Fish and Wildlife Service, Carlsbad, California.

The endangered Yuma Clapper Rail (*Rallus longirostris yumanensis*) occurs in marshes along the Colorado River and around the Salton Sea in Imperial and Riverside Counties in California. This study was designed to determine the potential for contaminant exposure of the Yuma Clapper Rail inhabiting the Imperial Valley by investigating the amounts of trace elements and organochlorine pesticides in its environment (sediments) and diet (crayfish) when Colorado River water was used in habitat ponds. Available tissue samples were also analyzed in an effort to assess the potential for biomagnification. Sediments were analyzed for a suite of inorganics including arsenic, boron, cadmium, chromium, copper, lead, mercury, selenium and zinc. Maximum concentrations were 15.1, 30.3, 1.5, 25.5, 31.7, 20.1, 0.035, 9.6, and 74.6 parts per million (ppm) dry weight (DW), respectively. Crayfish had detectable concentrations of these same analytes with the exception of lead which was not detected in any of the 19 samples. Maximum concentrations in ppm DW were: arsenic, 12.2; boron, 30.9; cadmium, 0.5; chromium, 2.0; copper, 127.5; mercury, 0.16; selenium, 4.7; and zinc, 107.1. Maximum egg concentrations (collected when drainwater was used in the ponds) for boron, mercury, and selenium were 2.3, 1.1, and 7.8 ppm DW, respectively. This selenium concentration is within the range of embryo viability effects. Tissue concentrations for the same elements were 17.4, 3.7 and 11.8 ppm DW, respectively. Only four organochlorine compounds were detected in any of the sediment samples. Most concentrations measured were close to the detection limit with the highest detected concentration being for p,p'DDE at 0.13 ppm DW (0.099 ppm wet weight (WW)). The two rail eggs had concentrations of this compound of 0.27 and 0.34 ppm fresh wet weight, but only three of the 19 crayfish samples had detectable concentrations. The range for crayfish was <0.01-0.045 ppm WW. Of all the constituents examined, selenium is of greatest concern to the Yuma Clapper Rail. Use of irrigation drainwater in its habitat is not recommended.

8. **THE ECOLOGY OF BURROWING OWLS IN THE IMPERIAL VALLEY, CALIFORNIA.** *DANIEL K. ROSENBERG and KATHERIN L. HALEY, Department of Fisheries and Wildlife, Oregon State University, Corvallis, OR; DAVID F. DESANTE and ERIC D.RUHLEN, The Institute for Bird Populations, Point Reyes Station, CA; MELISSA M. YORK, NOELLE RONAN, and JENNIFER A. GERVAIS, Department of Fisheries and Wildlife, Oregon State University Corvallis, OR; KEN K. STURM, Sonny Bono Salton Sea National Wildlife, Calipatira, CA.

Exceptionally high densities of Burrowing Owls exist in the Imperial Valley, an area that we estimated to include over 70% of the California population. Reproductive success in the Valley was generally lower than other California populations. Chick survival was related to food availability, and may have been manifested through higher rates of cannibalism and predation rather than starvation. Although pesticides were widely used, levels of DDE and other pesticide residues in eggs were low. Home-range size and spatial patterns of habitat use were similar to other California populations, but because of the high density of owls, overlap among pairs was higher. Edge habitat between roads, fields, and the irrigation system, were preferred foraging areas. The intensity of field use by the owls was dynamic, and apparently depended on the particular crop and irrigation practice. Although other California populations have a diet composed of both vertebrates and invertebrates, the diet in the Imperial Valley was mainly composed of invertebrates. The high year-round agricultural production in the Valley may support a high biomass of invertebrates, providing a relatively static food source for Burrowing Owls. This likely contributes to the large resident population. The presumably low biomass of rodents may be attributable to the same agricultural practices and may be a factor in the low reproductive success. We compare the ecology of Burrowing Owls in the Imperial Valley in comparison to other California populations and discuss local and regional management issues that may affect Burrowing Owls.

9. **THE SALTON SEA AS IMPORTANT WATERFOWL HABITAT IN THE PACIFIC FLYWAY.** *DOUGLAS A. BARNUM, U.S. Geological Survey, Delano, CA; STEVEN JOHNSON, U.S. Fish and Wildlife Service, Sonny Bono Salton Sea National Wildlife Refuge, Calipatria, CA.

The Salton Sea region is an important component of the Pacific Flyway for migrating and wintering waterfowl. The purpose of this paper is to illustrate the importance of the Salton Sea and its associated wetlands to Pacific Flyway waterfowl populations. For the period January 1986 through January 2000, the average midwinter count of waterfowl in the Salton Sea Region, including Imperial and Coachella Valleys, was 100,714 birds (USFWS unpubl. data). Setmire et al. 1993 estimated waterfowl use of the Salton Sea region in "recent years" at 125,000 birds annually, but it is unclear how that number is to be put in context. If the total numbers of migrants and wintering birds are considered over the entire year, then the actual number of waterfowl utilizing the Salton Sea is much greater. Meanwhile, the midwinter waterfowl counts for 11 Pacific States for roughly the same period of time, 1989-1999, indicates a Flyway average population of 5,421,707 birds (USFWS 1999). The Salton Sea midwinter waterfowl population thus represents less than 2% of the Pacific Flyway midwinter population. Similar data are being compiled for a comparison of Salton Sea populations to the rest of California. A comprehensive analysis of aerial survey data for waterfowl at the Salton Sea will delineate important species and habitat associations. Despite the apparent low percentage of wintering waterfowl, this paper will discuss and highlight the current importance of the Salton Sea in relation to Pacific Flyway populations and habitats.

10. **PATTERNS OF SHOREBIRD USE OF THE SALTON SEA, CALIFORNIA.** *W. DAVID SHUFORD, Point Reyes Bird Observatory, Stinson Beach, CA; ROBERT L. MCKERNAN, San Bernardino County Museum, Redlands, CA; NILS WARNOCK, Point Reyes Bird Observatory, Stinson Beach, CA.

We conducted comprehensive surveys of shorebirds at the Salton Sea three to four times per year from 1989 to 1995 and in 1999. In 1999, we also conducted 18 surveys of portions of the Salton Sea and 3 comprehensive surveys of the Imperial Valley for Mountain Plovers. Shorebird populations at the Salton Sea from 1989 to 1995 averaged 24,000 in December, 90,000 in April, and about 85,000 individuals in August; numbers totaled about 70,000 in November 1999. These data document the Salton Sea as one of only eight sites in the interior of western North America that holds over 10,000 shorebirds in fall and five such sites in spring; it was one of only a few sites in the interior holding thousands of shorebirds in winter. The species composition and relative abundance of shorebirds at the Salton Sea in winter was more similar to that in the Colorado River delta than in California's Central Valley. Conservation and restoration initiatives need to address the differential distribution patterns of shorebirds around the Salton Sea and between the Sea and the Imperial Valley. The number of Mountain Plovers wintering in irrigated agricultural fields in the Imperial Valley represents about 30% to 38% of the species' entire population. Also, the Salton Sea continues to support the largest population of wintering Snowy Plovers in the interior of western North America and is one of a handful of key breeding areas for the species in the interior of California.

11. **STATUS OF PELAGIC AND SUBTROPICAL WATERBIRDS AT THE SALTON SEA.** *GUY MCCASKIE, Imperial Beach, CA; MICHAEL A. PATTEN, Department of Biology, University of California, Riverside, CA.

In terms of biogeography, the Salton Sea has a close relationship with the Gulf of California. As a result, many species of seabirds and waterbirds that are rare in the interior of western North America occurring regularly (e.g., Brant, scoters, Least Tern), and sometimes commonly (e.g., Laughing and Yellow-footed Gulls), at the Salton Sea. Indeed, the strong relationship with the gulf has yielded nearly 40 records of eight species of Procellariiforms, the highly pelagic tubenoses. Likewise, species rare in the western United States, such as Blue-footed and Brown Boobies and Roseate Spoonbill, stage irregular incursions into the Salton Sink from their range in northwestern Mexico and the Gulf of California. Occurrences of all of them are non-random with respect to season. Virtually all records of these species and a host of others with similar ranges are from summer months, mainly May–October. During this period there is a dramatic change is wind patterns that favor dispersal and movement northward into the Salton Sink. Winds primarily blow southward from the San Gorgonio Pass through the Salton Sink to the Gulf of California during winter, but during summer a monsoonal flow develops annually such that winds from the gulf through the sink are exactly reversed. Movement of seabirds into the gulf is further aided by a change in sea surface temperatures off of west Mexico in summer. Sea surface temperatures off west Mexico are fairly cold in winter, with temperatures matching those off the Pacific coast of Baja California. These cold waters isolate the warm-water gulf during winter. Sea surface temperatures rise dramatically off west Mexico in summer, when much warmer than waters off the Pacific coast of Baja California and forming a uniform thermocline into the gulf, perhaps facilitating avian movement given the absence of a temperature "barrier." The geography of the Salton Sink effectively "traps" birds that reach it, given the mountainous barriers to the west, north, and east. Many seabirds and subtropical waterbirds that reach the sea presumably find their way back to the Gulf of California and west Mexico, although some are transients through the sink.

12. **AVIAN RANGE EXPANSIONS AND POPULATION CHANGES IN THE SALTON SINK DURING THE PAST QUARTER-CENTURY.** MICHAEL A. PATTEN, Department of Biology, University of California, Riverside, CA; RICHARD A. ERICKSON, LSA Associates, Irvine, CA.

When Salton Sea formed in 1905 it was merely another lake in a long series of lakes that had filled at least a portion of the Salton Sink. Lake Cahuilla was the principal historical forerunner, being last filled in the mid-1600s, but floods on the Colorado River carried water to the sink as late as 1891. The presence and persistence of the sea obviously greatly altered bird use of the region in the first third of the 20th Century. Increased agriculture, growing human settlements, and serious habitat alteration have affected bird use of the region in the past 25 years in almost as dramatic a fashion. As a general rule, landbirds colonizing the region have a distinctly Sonoran Desert affinity, with numerous species (e.g., White-winged Dove, Gila Woodpecker, Bronzed Cowbird) expanding westward into the novel suitable habitat of the Salton Sink. Most presumably reached the sink via the Río Hardy and Río Alamo drainages, thence to the Mexicali and Imperial Valleys. Fewer have colonized from cismontane southern California (e.g., Anna's Hummingbird, Northern Mockingbird), with these species moving into the Salton Sink from the north, via the San Gorgonio Pass. Other major expansions into the region have been part of broad scale range expansions by the species (e.g., Cattle Egret, White-faced Ibis, Inca Dove, Great-tailed Grackle), with agricultural and ranch land providing a wealth of habitat. By contrast, loss of mesquite bosques, formerly an abundant habitat in the Salton Sink, have led to the severe decline or extirpation of some species (e.g., Crissal Thrasher, Lucy's Warbler), whereas loss of open desert scrub has led to the virtual elimination of others (e.g., Le Conte's Thrasher). The Large-billed Savannah Sparrow (*Passerculus sandwichensis rostratus*), an endemic to the Gulf of California, has exhibited a mysterious pattern. It was common at the turn of the 20th Century, rare by the 1950s, and has become common again, with breeding recently established at Cerro Prieto, well north of the gulf. As a rule, seabirds and waterbirds have increased in the Salton Sink, with steep declines of the Wood Stork and Fulvous Whistling-Duck providing alarming exceptions.

13. **SALTON SEA BREEDING LARIDS: POPULATION TRENDS, COLONY SITES AND CONSERVATION.** KATHY C. MOLINA, Section of Vertebrates, Natural History Museum of Los Angeles County, Los Angeles, CA.

The Salton Sea currently supports one of the most species-rich communities of breeding larids in the interior of western North America. Composed of six species, this community regularly includes California Gulls (*Larus californicus*), Gull-billed (*Sterna nilotica*) and Caspian (*S. caspia*) Terns and Black Skimmers (*Rynchops niger*), with Laughing Gulls (*L. atricilla*) and Forster's Terns (*S. forsteri*) nesting sporadically. Many of these species maintain breeding populations that are of regional significance despite the paucity of suitable nesting habitat available. The larger of only two colonies of the Gull-billed Tern within the western United States occurs at the sea. During the 1990s, population size and colony site occupation were variable among years. Of the species that nested annually, the number of breeding pairs of Gull-billed Terns ranged from 72 to 170, that of Caspian Terns ranged from 30 to >1500, and that of Black Skimmers ranged from 80 to nearly 500 pairs. The California Gull colonized the sea in 1997 with 22 pairs and the number of breeding pairs has increased to >40 pairs. One or two pairs of Laughing Gulls have attempted to nest and up to 20 pairs of Forster's Terns have nested occasionally during this period. Loss of suitable habitat at traditional colony sites due to fluctuations in the sea's elevation and the recent colonization by a large population of Double-crested Cormorants and, to a lesser extent, California Gulls is thought to influence the site occupation of Gull-billed Terns and Black Skimmers. By 1997 these two species have been restricted to only two of six colony sites used previously during the decade. Most colony sites occur on private lands; only one colony site is actively managed for ground nesting waterbirds. Increased human disturbance at some sites is believed to adversely affect breeding success.

14. **THE BREEDING BIRDS OF ISLA MONTAGUE, DELTA DEL RÍO COLORADO, MÉXICO: APPARENT VARIATIONS AT DIFFERENT TEMPORAL SCALES.** ERIC MELLINK, Centro de Investigación Científica y de Educación Superior de Ensenada, Apartado Postal 2732, Ensenada, B.C., México.

Ten species of waterbirds and one landbird nest on Isla Montague, at the mouth of the Rio Colorado. These species are: Great Blue Heron, Snowy Egret, Black-crowned Night-Heron, Laughing Gull, Royal, Elegant, Least, and Gull-billed Terns, Black Skimmers, American Oystercatcher, and Large-billed Sparrow. These nesting birds exhibit the effects of environmental variables at different scales: within-year, among years, several years, and several decades. 1) Within a given year the major environmental factor affecting the breeding birds have been the tides. In 1994 the island was covered almost completely at least 5 times during the breeding season, destroying most of the nests. 2) A comparison of the 1993 and 1994 breeding season exhibited interannual differences that were not clearly interpretable, but variations in river discharge was the closest apparent possible cause. 3) The 1997-1998 El Niño event promoted larger colonies of Black Skimmers and Least, Royal, and Elegant Terns. 4) Although data are very scant and circumstantial, it appears that the breeding ornithofauna might have been different at the turn of the 20th century. At a regional scale, it is not yet understood which other localities are involved in the dynamics of breeding bird communities on Montague. The closest breeding localities for some of the nesting species are, to the south, several hundreds of kilometers away, but to the north only a short distance: Cerro Prieto and the Salton Sea. Although no data on regional movement of individuals exists, these three sites could form a biological unit.

15. **CLOSING REMARKS—FUTURE RESEARCH DIRECTIONS AND CONSERVATION PROSPECTS.** *W. DAVID SHUFORD, Point Reyes Bird Observatory, Stinson Beach, CA; KATHY C. MOLINA, Section of Vertebrates, Natural History Museum of Los Angeles County, Los Angeles, CA; MICHAEL A. PATTEN, Department of Biology, University of California, Riverside, CA.

No abstract.

Poster Presentations

16. **CHRISTMAS BIRD COUNT STUDY OF THE SALTON SEA.** SHUZO YOSHIHARA, University of Redlands, Redlands, CA.

Christmas Bird Counts (CBCs) have been conducted at the Salton Sea since 1969. Observers gather at dawn and count until dusk on one day within a week or so of Christmas each year. Thus, the CBC data represents a long-term data set—essentially one-day snapshots—of wintering bird use at the Salton Sea from 1969 to 1998. Total numbers of birds are tallied for each species observed within a 7.5-mile radius circle at the north and south ends of the Sea, as shown on the map montage. More than 150 species of birds have been observed during the Salton Sea CBCs. From these data, we have presented the following trend analyses for the North, South and Total CBC counts: total number of birds counted, fish eating birds, shorebirds, geese, pelicans, and cormorants. The graphs depict the North, South and Total counts for each census year. Regression analyses were performed to determine positive or negative trends. R^2 values of greater than 50% indicate a positive fit of actual data to the linear regression line. *P* values denote the probability that the data is random, assuming its variance; *P* values of less than 5% are considered to represent definite trends.

17. **AVIAN DISEASE AT THE SALTON SEA.** MILTON FRIEND, Salton Sea Science Subcommittee, Middleton, WI.

Recent disease outbreaks at the Salton Sea have killed large numbers of birds. These events have resulted in a national focus on the sea and issues associated with restoration actions. A review of existing information on disease occurrence was conducted from historical records, National Wildlife Refuge Narrative Reports, and the National Wildlife Health Center epizootic and diagnostic databases. There has been a substantial increase since the late 1980s in the importance of disease as a cause of bird mortality at the sea. Outbreaks have occurred since at least the 1920s. With the exception of 1932, annual outbreaks occurred during the period of 1925–1935, with each event killing a substantial number of birds. Type C botulism was the likely cause of those outbreaks. The frequency of outbreaks was much lower from 1936–1945 before increasing again since 1946. With few exceptions the magnitude of bird deaths associated with individual disease outbreaks during the period of 1936–1987 has been low. Since 1987, the magnitude of losses from disease has increased substantially and there have been a number of catastrophic die-offs. During 1992, an estimated 155,000 birds died at the sea, including ±150,000 Eared Grebes, approximately 7% of the species' continental population. The cause of this event and recurring grebe mortality at the sea has not been determined despite extensive diagnostic evaluations. The 1996 outbreak of type C botulism was even more devastating regarding population impacts. That outbreak killed approximately 15–20% of the western population of American White Pelicans and killed more than 1,000 endangered California Brown Pelicans. During 1997 and again in 1098, all hatchlings from the Double-crested Cormorant colony on Mullet Island died from Newcastle disease. Avian cholera and salmonellosis are other important diseases that have appeared at the Salton Sea during recent years. Environmental quality is a factor in many disease events. The Salton Sea Restoration Project focus on improving the sea's environmental quality is a fundamental action required to reduce probability of major losses from disease. Current actions include enhanced surveillance to provide early detection of disease occurrences and aggressive response to outbreaks. Studies have been initiated to gain a greater understanding of the ecology of disease at the Sea. Findings from those studies will be of considerable value in guiding management actions to achieve the Restoration Project Goal to: "Provide a safe, productive environment at the Sea for resident and migratory birds and endangered species." Achievement of this goal is important because >90% of inland wetland acreage that was part of the California landscape no longer exists. As a result, millions of migratory birds within the Pacific Flyway have become highly dependent upon the habitat provided by the Salton Sea.

Author Index by Abstract Number