



U.S. DEPARTMENT OF THE INTERIOR

U.S. GEOLOGICAL SURVEY
MINNESOTA COOPERATIVE FISH AND WILDLIFE RESEARCH UNIT

UNIVERSITY OF MINNESOTA
200 HODSON HALL; 1980 FOLWELL AVENUE
ST. PAUL, MN 55108-6124
(612) 624-3421 (612) 625-5299 (fax)
coopunit@tc.umn.edu

2008 Coordinating Committee Meeting

8 October 2008

SUMMARY OF ACTIVITIES (2007 AND 2008 CALENDAR YEARS)

PUBLICATIONS

Peer reviewed

- Anderson, D.H. and **Fulton, D.C.** Experience preferences as mediators of the wildlife related recreation participation-place attachment relationship. *Human Dimensions of Wildlife* 13:73-88.
- Bruskotter, J. T. and **Fulton, D.C.** Minnesota anglers' fisheries-related value orientations and their stewardship of fish resources. *Human Dimensions of Wildlife* 13:207-221.
- Frost Nerbonne, J. A., B. Ward, A. Ollila, M. Williams, and **B. Vondracek**. 2008. Volunteer sampling bias using multihabitat sampling for macroinvertebrates. *Journal of the North American Benthological Society* 27:640-646.
- Henneman, C., M.A. McLeod, and **D.E. Andersen**. 2007. Red-shouldered hawk occupancy surveys in central Minnesota, USA. *Journal of Wildlife Management* 71:526-533.
- Magner, J. A., **B. Vondracek**, and K. N. Brooks. 2008. Channel stability, habitat and water quality in South-eastern Minnesota (USA) streams: assessing managed grazing practices. *Environmental Management* 42:377-390.
- Muenier, J., R. Song, R.S. Lutz, **D.E. Andersen**, K.E. Doherty, J.G. Bruggink, and E. Oppelt. 2008. Proximate cues for a short-distance migratory species: an application of survival analysis. *Journal of Wildlife Management* 72:440-448.
- Perry, E.F., **D.E. Andersen**, and J.C. Manolis. 2008. Reduced predation at interior nests in clustered all-purpose territories of least flycatcher (*Empidonax minimus*). *Auk* 125:643-650.
- Reiter, M.E. and **D.E. Andersen**. 2008. Trends in abundance of collared lemmings near Cape Churchill, Manitoba. *Journal of Mammalogy* 89:138-144.

Sammler, J.E., **D.E. Andersen**, and S. Skagen. 2008. Population trends of tundra-nesting birds at Cape Churchill, Manitoba, in relation to increasing goose populations. *Condor* 110:325-334.

Zimmerman, J.K.H. and **B. Vondracek**. 2007. Brown trout and food web interactions in a Minnesota stream. *Freshwater Biology* 52:123-136.

Book chapter and symposium proceedings

Andersen, D. E. 2007. Raptor survey techniques. Pages 89-100 in D.M. Bird and K. Bildstein, eds. Raptor research and management techniques (revised edition). Hancock House Publishers, Blaine, Washington, USA.

Andersen, D.E. 2007. The Goshawk. (*Book Review*). *Journal of Field Ornithology* 78:440-441.

Bruskotter, J. T. and **Fulton, D.C.** 2007. The influence of angler value orientations on fisheries stewardship norms. Pages 157-167 in Aquatic Stewardship Education in Theory and Practice, B.A. Knuth and W. F. Siemer (Eds.). American Fisheries Society Symposium 55. Bethesda, Maryland.

Fulton, D.C. and M.J. Manfredo. 2008. The biological context of wildlife values: Are there etchings on the slate? Pages 73-89 in Who cares about wildlife? Social science concepts for exploring human-wildlife relationships and conservation issues. Springer, New York, New York.

MANUSCRIPTS (AND BOOK REVIEWS) IN PRESS, IN REVIEW, OR IN REVISION

Andersen, D.E., M.E. Reiter, K.E. Doherty, and D.C. Fulton. *In Press*. Magnitude and spatial distribution of American woodcock hunting pressure in a central Minnesota wildlife management area. *Proceedings of the 10th American Woodcock Symposium*.

Asmus, B., J. Magner, **B. Vondracek**, and J. Perry. *In revision*. Physical integrity: the missing link in biological monitoring and TMDLs. *Environmental Monitoring and Assessment*.

Au, L., **D.E. Andersen**, and M. Davis. *In Press*. Patterns in bird community structure related to restoration of Minnesota dry oak savannas. *Natural Areas Journal*.

Blann, K.L., J. Anderson, G. Sands, and **B. Vondracek**. *In Press*. Effects of agricultural subsurface drainage on aquatic ecosystems: a review. *Critical Reviews in Environmental Science and Technology*.

Bruskotter, J.T., **D.C. Fulton**, M. Payton, **B. Vondracek**. *In Revision*. Land conservation in practice: predicting the use of government-sponsored land conservation programs. *Environmental Management*.

Doherty, K.E., **D.E. Andersen**, J. Meunier, E. Oppelt, R.S. Lutz, and J.G. Bruggink. *In Revision*. Past patch quality as a predictor of future habitat selection: relating movement behavior of American woodcock to environmental factors. *Condor*.

- Eells, L., R. Vondracek, and **B. Vondracek**. *In Revision*. Hunting or fishing for information. *In* Scientific communication for natural resource professionals. C. Jennings, T. E. Lauer, and B. Vondracek (editors).
- Fulton, D.C.**, M.J. Manfredo and D.H. Anderson. *In Press*. Outcomes-based management of fisheries and wildlife. *In* Benefits-based management. B.L. Driver (editor).
- Gresswell, R. and **B. Vondracek**. *In Revision*. Coldwater streams. *In* Inland fisheries management in North America (3rd edition). W. A. Hubert and M. C. Quist (editors).
- Henneman, C. and **D.E. Andersen**. *In Revision*. Habitat associations of red-shouldered hawks in central Minnesota landscapes. *Journal of Wildlife Management*.
- Merten, E. C., N. A. Hemstad, R. M. Newman, **B. Vondracek**, E. S. Verry, and R. K. Kolka. *In Review*. Persistence of fine sediments in low-gradient headwater streams following forest harvest. *Forest Ecology and Management*.
- Merten, E. C., N. A. Hemstad, **B. Vondracek**, R. M. Newman, L. a B. Johnson, S. L. Eggert, and R. K. Kolka. *In Review*. Changes in fish populations in a northern Minnesota stream system from 1997 to 2007: effects of forest harvest or climate change. *Freshwater Biology*.
- Meunier, J., L.S. Lutz, K.E. Doherty, **D.E. Andersen**, E. Oppelt, and J.G. Bruggink. *In Revision*. Fall diurnal habitat use by adult female American woodcock in the western Great Lakes region. *Proceedings of the 10th American Woodcock Symposium*.
- Oppelt, E., J.G. Bruggink, K.E. Doherty, **D.E. Andersen**, J. Meunier, and R.S. Lutz. *In Review (abstract)*. Fall survival of American woodcock in the western Great Lakes region. *Proceedings of the 10th American Woodcock Symposium*.
- Reiter, M.E. and **D.E. Andersen**. *In Review*. Examining the bird-lemming hypothesis at Cape Churchill, Manitoba. *Canadian Journal of Zoology*.
- Reiter, M.E. and **D.E. Andersen**. *In Press*. Comparing egg floatation and egg candling to estimate incubation day of Canada Goose nests. *Journal of Field Ornithology*.
- Reiter, M.E., **D.E. Andersen**, and C.W. Boal. *In Review*. Species composition, distribution, and habitat associations of anurans in a subarctic tundra landscape near Cape Churchill, Manitoba, Canada. *Canadian Field-Naturalist*.
- Schramm, H. L., Jr., W. E. French, and **B. Vondracek**. *In Press*. Mortality of walleye caught in live-release tournaments. *Proceedings of the Fourth National Reservoir Symposium*.
- Schroeder, S. A. and **D. C. Fulton**. *In Review*. Land of 10,000 lakes and 2.3 million anglers: conflict, crowding, and coping among Minnesota anglers. *Journal of Leisure Research*.
- Schroeder, S. A., **Fulton, D. C.**, Nemeth, M.E., Sigurdson, R. E., and Walsh, R. J. *In Press*. Fishing in the neighborhood: understanding motivations and constraints for angling among Minneapolis-St. Paul, Minnesota metro residents. *In* Urban Fishing Symposium proceedings. American Fisheries Society. Bethesda, Maryland.

Streby, H.M. J.M. Refsnider, S.M. Peterson, and **D.E. Andersen**. *In Press*. Barred owl predation on hermit thrush and ovenbird fledglings. *Journal of Raptor Research*.

MANUSCRIPTS IN PREPARATION

Andersen, D.E., J.C. Manolis, and E.F. Perry. *In Preparation*. Broad-winged hawk (*Buteo platypterus*) breeding density and reproduction in northern hardwood forest habitats in north-central Minnesota. *Journal of Raptor Research*.

Atuke, D. M., R. M. Newman, **B. Vondracek**, and C. R. Blinn. *In Preparation*. Analysis of the factors that influence knowledge of, compliance with, and implementation of forest policies protecting riparian and aquatic resources in Kenya. *Society and Natural Resources*.

Atuke, D. M., R. M. Newman, **B. Vondracek**, and C. R. Blinn. *In Preparation*. Application and effectiveness of best management practices for forest harvesting to protect water quality in south-west Mau, Kenya. *Journal of Tropical Ecology*.

Atuke, D. M., R. M. Newman, and **B. Vondracek**. *In Preparation*. Suitability of forestry BMPs for riparian and aquatic resource protection in Kenya: exploring the need, application and effective use. *International Journal of Water Resources Development*.

Atuke, D. M., R. M. Newman, and **B. Vondracek**. *In Preparation*. Effects of riparian forest harvest on instream habitat and fish assemblages in eight northern Minnesota streams. *Canadian Journal of Fisheries and Aquatic Sciences*.

Atuke, D. M., R. M. Newman, and **B. Vondracek**. *In Preparation*. Influence of riparian forest harvest on water quality and macroinvertebrate communities in northern Minnesota streams. *Journal of the North American Benthological Society*.

Blann, K.L. and **B. Vondracek**. *In Preparation*. Fish distribution in relation to spatial scale: lessons from southeastern Minnesota. *Transactions of the American Fisheries Society*.

Boody, G., P. Gowda, J. Westra, C. van Schaik, P. Welle, **B. Vondracek**, and D. Johnson. *In Preparation*. Multifunctional grass farming: science and policy considerations. Proceedings of Farming with grass: achieving sustainable mixed agricultural landscapes.

Cornicelli, L., **D.C. Fulton** and M. Grund. *In Preparation*. Minnesota deer hunters' preferences for alternative regulations. *Journal of Wildlife Management*.

Cornicelli, L. J. Fieberg, **D.C. Fulton**. *In Preparation*. Development of a simplified choice method to identify hunter preferences for regulatory action. *Journal of Wildlife Management*.

Doherty, K. and **D.E. Andersen**. *In Preparation*. Kernel home range estimation using conventional telemetry data from birds: the example of American woodcock. *Journal of Field Ornithology*.

- Fulton, D.C.**, S. Schroeder, J. Lawrence. *In Preparation*. A study of motivational and preferences changes in a panel of Minnesota waterfowl hunters 2000-2005. *Human Dimensions of Wildlife*.
- Fulton, D.C.** and M.J. Manfredo. *In Preparation*. The effects of regulatory restriction on hunter participation and satisfaction. *Human Dimensions of Wildlife*.
- Loomis, J. H, **B. Vondracek**, and H. L. Schramm, Jr. *In Preparation*. The survival and blood chemistry response of walleye to a simulated live-release fishing tournament. *North American Journal of Fisheries Management*.
- Manolis, J.C., F.J. Cuthbert, and **D.E. Andersen**. *In Preparation*. Predation of artificial nests in relation to clearcut edges in an extensively forested landscape. *Auk*.
- Oppelt, E., J.G. Bruggink, K.E. Doherty, **D.E. Andersen**, J. Meunier, and R.S. Lutz. *In Preparation*. Fall survival of American woodcock in the western Great Lakes region. *Journal of Wildlife Management*.
- Salk, R., **D. C. Fulton** and J. Vlaming. *In Preparation*. Developing a fishing opportunity spectrum: an example of Minnesota trout anglers. *North American Journal of Fisheries Management*.
- Schramm, H. L., Jr., **B. Vondracek**, W. E. French, and P. D. Gerard. *In Preparation*. Factors associated with mortality of walleye and sauger caught in live-release tournaments. *North American Journal of Fisheries Management*.
- Schroeder, S. A. and **D.C. Fulton**. *In Preparation*. Do outdoor recreation and place attachment relate to Minnesota lake home owners' attitudes about protecting their lake? *Society and Natural Resources*.
- Schroeder, S. A. and **D.C. Fulton**. *In Preparation*. Place attachment as an affective precursor in norm activation theory: predicting personal norms and behavioral intentions for protection and removal of native aquatic plants by Minnesota lakeshore property owners. *Human Dimensions of Wildlife*.
- Schroeder, S. A. and **D.C. Fulton**. *In Preparation*. Political action and philanthropy for lake protection: do outdoor recreation participation and place attachment predict intention to conserve Minnesota lakes? *Society and Natural Resources*.
- Vondracek , B.**, H. L. Schramm, Jr., W E. French, and C. J. Chizinski. *In Preparation*. Factors associated with initial mortality of walleye and sauger caught in live-release tournaments. *North American Journal of Fisheries Management*.
- Vondracek , B.**, H. L. Schramm, Jr., D. C. Fulton, J. H. Loomis, J. T. Bruskotter, W E. French, C. J. Chizinski, and P. D. Gerard. *In Preparation*. Survival of walleye caught in live-release tournaments and assessment of acceptable levels for anglers. *North American Journal of Fisheries Management*.
- Vondracek, B.**, J. Stucker, and F. Cuthbert. *In Preparation*. Macroinvertebrate communities and riparian physical habitats of southeastern Minnesota. *Oecologia*.

TECHNICAL REPORTS

Final reports

Fulton, D.C. and L. Cornicelli. 2007. Results of 2005 survey of state park deer hunter satisfaction and preferences for regulation changes in Minnesota. Final Report to the Minnesota Department of Natural Resources, St. Paul, Minnesota.

Mannan, R.N. 2008. An assessment of survey methodology, calling activity, and habitat associations of wood frogs (*Rana sylvatica*) and boreal chorus frogs (*Pseudacris maculata*) in a tundra biome. M.S. thesis, Texas Tech University, Lubbock, Texas. Final Report to Wapusk National Park of Canada, Churchill, Manitoba, Canada.

Wilson, B., **B. Vondracek**, J. Nieber, and J. Perry. 2008. A stream classification for TMDL assessment using a dimensionless, reference reach approach. Final report to the U.S. Environment Protection Agency for EPA Agreement Number: RD-83136601-1.

Winter, M. and D. Johnson. 2007. Effects of breeding birds of seeding mixtures on planted grasslands. Final report to the U.S. Geological Survey, Jamestown, North Dakota.

Annual Reports

Andersen, D.E., et al. 2007. Production of EPP Canada geese near Cape Churchill in 2007. Annual report to the Mississippi Flyway Council. Minnesota Cooperative Fish and Wildlife Research Unit, St. Paul, Minnesota.

Andersen, D.E., et al. 2008. Production of EPP Canada geese near Cape Churchill in 2008. Annual report to the Mississippi Flyway Council. Minnesota Cooperative Fish and Wildlife Research Unit, St. Paul, Minnesota.

Andersen, D.E., M. Gillespie, and G. Ball. 2008. Mississippi Flyway Eastern Prairie Population (EPP) Canada goose monitoring. Annual Report to Wapusk National Park of Canada, Churchill, Manitoba, Canada.

Bruggeman, J.E., **D.E. Andersen**, and J.E. Woodford. 2007. Goshawk monitoring in the western Great Lakes Bioregion: overview of 2008 sampling options. Progress report to U.S. Forest Service. Minnesota Cooperative Fish and Wildlife Research Unit, St. Paul, Minnesota.

Mannan, R.N., G. Perry, **D.E. Andersen**, and C.W. Boal. 2007. Factors affecting distribution and detection of boreal chorus frogs (*Pseudacris maculata*) and wood frogs (*Rana sylvatica*) at Cape Churchill, Manitoba. Annual report to Wapusk National Park of Canada, Churchill, Manitoba. Minnesota Cooperative Fish and Wildlife Research Unit, St. Paul, Minnesota.

- Mannan, R.N. and **D.E. Andersen**. 2008. Distribution and habitat relationships of frogs in coastal tundra at Cape Churchill. Annual Report to Wapusk National Park of Canada, Churchill, Manitoba, Canada.
- Nelson, M.R., **D.E. Andersen**, and J.R. Kelly. 2008. American woodcock Singing-ground Surveys in the western Great Lakes region: assessment of trends in woodcock counts, forest cover types along survey routes, and landscape cover type composition: 2007 summary report. Annual report to the U.S. Fish and Wildlife Service, Webless Migratory Game Bird Research Program. Minnesota Cooperative Fish and Wildlife Research Unit, St. Paul, Minnesota.
- Reiter, M.E. and **D.E. Andersen**. 2007. Sympatric nesting Eastern Prairie Population (EPP) Canada geese and lesser snow geese on the Hudson Bay Lowlands: nest depredation and spatial distribution. Annual report to the Mississippi Flyway Council. Minnesota Cooperative Fish and Wildlife Research Unit, St. Paul, Minnesota.
- Reiter, M.E. and **D.E. Andersen**. 2008. Sympatric nesting Eastern Prairie Population (EPP) Canada geese and lesser snow geese on the Hudson Bay Lowlands: nest depredation and spatial distribution. Annual report to the Mississippi Flyway Council. Minnesota Cooperative Fish and Wildlife Research Unit, St. Paul, Minnesota.
- Reiter, M.E. and **D.E. Andersen**. 2008. Interactions between nesting Canada geese and lesser snow geese. Annual Report to Wapusk National Park of Canada, Churchill, Manitoba, Canada.
- Streby, H.M. and **D.E. Andersen**. 2007. Habitat use of post-fledging forest-nesting songbirds in northern hardwood-coniferous forests in northern Minnesota: 2007 summary report. Annual Report to the U.S. Geological Survey (SSP) and the U.S. Fish and Wildlife Service. Minnesota Cooperative Fish and Wildlife Research Unit, St. Paul, Minnesota.

GRANT PROPOSALS

Funded

David E. Andersen

Ecology of Eastern Prairie Population Canada geese banded on the breeding grounds.
Funding: Mississippi Flyway Council. \$20,000.

Bioregional monitoring for northern goshawks in the western Great Lakes.
Funding: U.S. Forest Service - \$42,452; Wisconsin Department of Natural Resources - \$3,000.
Funding: U.S. Forest Service - \$75,000.

American woodcock singing ground surveys in the western Great Lakes region: assessment of trends in woodcock counts, forest cover types along survey routes, and landcover type composition.
Funding: U.S. Fish and Wildlife Service (Webless Migratory Game Bird Research Program) - \$88,063; Minnesota Department of Natural Resources - \$19,500; Wisconsin

Department of Natural Resources - \$9,000; Woodcock Minnesota - \$2,500; Minnesota Cooperative Fish and Wildlife Research Unit - \$5,000.

Factors affecting detection of American woodcock on Singing-ground Surveys.
Funding: U.S. Fish and Wildlife Service - \$155,000.

David C. Fulton

Understanding human behaviors concerning Lake Shoreline management
Funding: Minnesota Department of Natural Resources \$79,000

Synthesizing human dimensions information on Minnesota anglers to frame an outcomes-based management system for fishing in Minnesota
Funding: Minnesota Department of Natural Resources \$65,000

Understanding support for non-toxic shot regulations
Funding: Minnesota Department of Natural Resources \$18,000

Bruce Vondracek

Scaleable Indices of Watershed Health
Funding: Minnesota Department of Natural Resources \$110,000

OUTREACH AND TECHNICAL ACTIVITIES

David E. Andersen

Assisted in operational data collection for Eastern Prairie Population Canada Goose Committee of the Technical Section of the Mississippi Flyway Council at Cape Churchill, Manitoba, Canada

Member, Eastern Prairie Population Canada Goose Committee of the Technical Section of the Mississippi Flyway Council.

Popular articles for *The Splash* (Woodcock Minnesota) on woodcock research in Minnesota.

Posters for Woodcock Minnesota fundraiser describing woodcock research and management activities in Minnesota.

Woodcock Minnesota and Finlayson-Geise Sportsman's Club private land woodcock initiative, Pine County, Minnesota.

David C. Fulton

Interviewed by Twin Cities Public Television for film special on declining participation in outdoor recreation. September 2007.

Member of the Human Dimensions review team to develop models for integrating social science on hunter recruitment and retention into Adaptive Harvest Management for waterfowl in North America.

Bruce Vondracek

Invited to be a member of a Science Advisory Panel coordinated by the Water Resources Center at the University of Minnesota on behalf of the Minnesota Pollution Control Agency.

The Science Advisory Panel includes technical specialists from local and state agencies and academic institutions in Minnesota and Wisconsin. The Panel serves as a technical consultant for the Stakeholder Advisory Committee to resolve technical issues related to the State of Minnesota's Lake Pepin TMDL and the Minnesota River TMDL. The Panel first convened in February 2005 and is expected to end November 2008.

Invited participant, Impaired Waters Symposium that targeted a group of researchers, implementers, NGOs and decision-makers, including key Minnesota Legislature Committee chairs, to develop a research agenda to identify needs for the Clean Water Council, State Agencies, Legislature and Researchers. The symposium was sponsored by the Minnesota Department of Agriculture, Board of Water and Soil Resources, Minnesota Department of Agriculture, Minnesota Department of Planning (Environmental Quality Board), Minnesota Pollution Control Agency and University of Minnesota Water Resources Center. 11-12 February 2008.

Invited member of Phase 2 of the statewide comprehensive plan for the conservation and preservation (CPCP) of Minnesota's environment and natural resources. The goal of the plan is to provide both short-term and long-term guidance on the conservation and preservation of Minnesota's environment and natural resources. The plan will enable a wide variety of public and private decision makers to work together to achieve common overall environment and natural resource goals and ensure their sustainability. The plan will also enable the Legislative Citizen's Committee for Minnesota Resources to be effective in strategically recommending funds to future applicants to help implement the shared vision of the plan to conserve, preserve, restore, and enhance Minnesota's environment and natural resources. This plan will also be used to help inform funding recommendations for the Environment and Natural Resources Trust Fund.

Technical Advisory Committee, member, Browns Creek Biological TMDL for the Browns Creek Watershed District and the Washington Conservation District. The Technical Advisory Committee first convened in April 2007 and is expected to end November 2008.

PRESENTATIONS

Andersen, D.E. 2008. *(Invited)*. Survey techniques. 2008: Annual Meeting of the Raptor Research Foundation, Inc. Workshop on Raptor Research and Management Techniques. Missoula, Montana.

Andersen, D.E. and H.M. Streby. 2007. *(Invited)*. Minnesota Cooperative Fish and Wildlife Research Unit forest bird monitoring: forest-nesting songbirds, forest raptors, and American woodcock. Minnesota Breeding Birds Inventory and Monitoring Workshop, Duluth, Minnesota.

Bronk, R. and **B. Vondracek**. 2007. Effects of macroinvertebrate availability, diet, and habitat on reintroduction success of slimy sculpin in southeast Minnesota. Minnesota Water Resources Conference. (POSTER)

- Bronk, B., D. Huff, and **B. Vondracek**. 2008. Effects of macroinvertebrate availability, diet, and habitat on reintroduction success of slimy sculpin in southeast Minnesota. Annual meeting of the Minnesota Chapter of the American Fisheries Society, Alexandria, Minnesota.
- Bronk, R. and **B. Vondracek**. 2008. Effects of macroinvertebrate availability, diet, and habitat on reintroduction success of slimy sculpin in Southeast Minnesota. Annual meeting of the North American Benthological Society, Salt Lake City, Utah.
- Bruggeman, J., **D.E. Andersen**, and J. Woodford. 2007. Northern goshawk monitoring in the western Great Lakes region. 68th Midwest Fish and Wildlife Conference, Madison, Wisconsin.
- Bruskotter, J.T and **D.C. Fulton**. 2007. Assessing accuracy of angler information collected at point of sale. 68th Midwest Fish and Wildlife Conference, Madison, Wisconsin.
- Chizinski, C. J. D. Atuke, N. Hemstad, E. Merten, **B. Vondracek**, R. M. Newman, and C. Blinn. 2008. Effects of riparian forest harvesting on the aquatic ecosystem in northern Minnesota streams. 93rd Annual Meeting of the Ecological Society of America, Milwaukee, Wisconsin.
- Dolph, C. and **B. Vondracek**. 2008. Use of simulated data to understand the variability of biological indicators in streams. Annual Meeting of the Minnesota Chapter of the American Fisheries Society, Alexandria, Minnesota.
- Fulton, D.C.**, Schroeder, S.A., Lawrence, J.S., and Cordts, S. D. Changes in waterfowl hunter participation, motivations and satisfaction over time. 68th Midwest Fish and Wildlife Conference, Madison, Wisconsin.
- Gillespie, M. and **D.E. Andersen**. 2008. (*Invited*). Canada geese in the Hudson Bay Lowlands—how research compliments management actions. Wapusk National Park Research and Monitoring Conference, Winnipeg, Manitoba, Canada.
- Green, M. B, B. N. Wilson, J. Nieber, J. Perry, and **B. Vondracek**. Using a dimensionless multivariate analysis technique to explore the landscape influence on stream ecosystem health. Minnesota Water Resources Conference, Brooklyn Center, Minnesota.
- Huff, D. D., L. M. Miller and **B. Vondracek**. 2008. Native fish reintroductions: applying ecological and genetic exchangeability and anthropogenic disturbance to the decision making process. Annual Meeting of the Minnesota Chapter of the American Fisheries Society, Alexandria, Minnesota. (POSTER)
- Huff, D. D., L. M. Miller and **B. Vondracek**. 2007. Review of animal reintroductions: applying ecological and genetic exchangeability and anthropogenic disturbance to the decision making process. 68th Midwest Fish and Wildlife Conference, Madison, Wisconsin. (POSTER)
- Lawrence, J.S., Schroeder, S.A., **Fulton, D.C.** and Cordts, S.D. 2007. Waterfowl hunters and resource agency employees: Do they view waterfowl hunting the same? 68th Midwest Fish and Wildlife Conference, Madison, Wisconsin.

- Loomis, J., **B. Vondracek**, and H. Schramm. 2008. Walleye mortality and blood chemistry associated with livewell operation during simulated live-release tournaments. Annual Meeting of the Minnesota Chapter of the American Fisheries Society, Alexandria, Minnesota. (BEST STUDENT PRESENTATION)
- Merten, E., R. Newman, **B. Vondracek**, L. Johnson, R. Kolka, E. S. Verry, and S. Eggert. 2007. Forest harvest effects on a northern Minnesota stream system: nine years later. Minnesota Water Resources Conference. Brooklyn Center, Minnesota.
- Merten, E., N. Hemstad, R. Newman, **B. Vondracek**, L. Johnson, R. Kolka, E. S. Verry, and S. Eggert. 2008. Forest harvest effects on a northern Minnesota stream system: a study spanning 11 years. 93rd Annual Meeting of the Ecological Society of America, Milwaukee, Wisconsin.
- Reiter, M.E. and **D.E. Andersen**. 2007. Cycles and synchrony in historical trends of collared lemming abundance near Cape Churchill, Manitoba, Canada. 14th Annual Meeting of The Wildlife Society, Tucson, Arizona.
- Reiter, M.E. and **D.E. Andersen**. 2008. Factors influencing nest density of Eastern Prairie Population Canada geese in northern Manitoba: potential impacts of lesser snow goose-mediated habitat alteration. 69th Midwest Fish and Wildlife Conference, Columbus, Ohio.
- Schroeder, S. A. and **D. C. Fulton**. (*Invited*). Untangling the line: constraints to fishing participation in communities of color. 137th Annual Meeting of the American Fisheries Society, San Francisco, California.
- Schroeder, S. A. and **D.C. Fulton**. (*Invited*). Fishing in the neighborhood: understanding motivations and constraints for angling among Minneapolis-St. Paul, Minnesota metro residents. 137th Annual Meeting of the American Fisheries Society, San Francisco, California.
- Schroeder, S. A., **D.C. Fulton**, J.S. Lawrence, and S.D. Cordts. 2007. The great hunter migration: why some Minnesota residents hunt waterfowl exclusively in North Dakota while others hunt at home. 67th Midwest Fish and Wildlife Conference, Madison, Wisconsin.
- Streby, H.M. and **D.E. Andersen**. 2008. Edge effects and ovenbirds in northern hardwood forests: are clearcuts really all that bad? 15th Annual Meeting of The Wildlife Society, Miami, Florida.
- Streby, H.M. and **D.E. Andersen**. 2007. Habitat use of post-fledging forest-nesting songbirds in northern hardwood-coniferous forests of northern Minnesota. Annual Meeting of the Minnesota Chapter of The Wildlife Society, Alexandria, Minnesota.
- Streby, H.M. and **D.E. Andersen**. 2007. Post-fledging habitat use by ovenbirds on the Chippewa National Forest, Minnesota. 68th Midwest Fish and Wildlife Conference, Madison, Wisconsin.

TEACHING

David E. Andersen

Invited lecture

Fall 2007: **FW1001: Introduction to Fisheries, Wildlife, and Conservation Biology**

Imperiled Arctic ecosystems: snow goose impacts on tundra birds

Department of Fisheries, Wildlife, and Conservation Biology

David C. Fulton

Instructor

Spring 2007. **FW5003: Human Dimensions of Biological Conservation**

Department of Fisheries, Wildlife, and Conservation Biology

Spring 2007 **FW 5382: Social Science Research for Land Use Planning.**

Department of Fisheries, Wildlife, and Conservation Biology

Fall 2008 **ESPM 5245: Sustainable Land Use Planning**

Bruce Vondracek

Instructor

Fall 2007 **CBIO8201: Seminar - How to excel in graduate school**

Department of Fisheries, Wildlife, and Conservation Biology

Fall 2007 **FW8465: Fish habitats and restoration**

Department of Fisheries, Wildlife, and Conservation Biology

Fall 2008 **CBIO8201: Seminar- How to excel in graduate school**

Department of Fisheries, Wildlife, and Conservation Biology

Invited lecture

Fall 2008 **GEO 8601: Introduction to Stream Restoration**

Department of Fisheries, Wildlife, and Conservation Biology

STUDENT THESES AND AWARDS (2007/2008)

Atuke, D. M. 2008. Effectiveness of riparian forestry best management practices to protect stream habitat and biota: lessons from temperate and tropical systems. Ph.D. dissertation. University of Minnesota. 273pp. (B. Vondracek).

Bronk, R. 2008. Macroinvertebrate composition, habitat, and diet in relation to the reintroduction of slimy sculpin in southeast Minnesota. M.S. Thesis, University of Minnesota. 44pp. (B. Vondracek).

Bruskotter, J. 2007. Value orientations and the practice of conservation: applications in fisheries management and agriculture. Ph.D. dissertation. University of Minnesota. 173pp. (D.C. Fulton).

Dolph, C. 2008. Empowering water quality decisions: reducing uncertainty and bounding variability of stream ecosystem indicators. M.S. Thesis, University of Minnesota. 63pp. (B. Vondracek).

Loomis, J. H. 2008. The survival and blood chemistry response of walleye *sander vitreus* to a simulated live-release fishing tournament. M.S. Thesis, University of Minnesota. 51pp. (B. Vondracek).

Student Awards

David Huff. 2008-2009. Graduate School Dissertation Fellowship, University of Minnesota.

John Loomis. 2008. Best Student Presentation, Annual Meeting of the Minnesota Chapter of the American Fisheries Society

Matthew Reiter. 2007. Student Travel Grant, The Wildlife Society.

Matthew Reiter. 2008-2009. Graduate School Dissertation Fellowship, University of Minnesota.

GRADUATE STUDENTS ADVISED

David E. Andersen

Matthew Nelson – M.S., Natural Resources Science and Management (Wildlife Ecology and Management)

Matthew Reiter – Ph.D., Wildlife Conservation

Henry Streby – Ph.D., Natural Resources Science and Management (Wildlife Ecology and Management)

Stefanie Bergh – M.S., Natural Resources Science and Management (Wildlife Ecology and Management)

R. Nicholas Mannan – M.S., Wildlife Science (Texas Tech University, co-advisor with Gad Perry and Clint Boal)

David C. Fulton

Jeremy Bruskotter – Ph.D., Natural Resource Science and Management (Environmental Science Policy and Management). Completed October 2007.

Louis Cornicelli – Ph.D., Natural Resource Science and Management (Environmental Science Policy and Management)

Susan A. Schroeder – Ph.D., Natural Resource Science and Management (Environmental Science Policy and Management)

Ed Rudberg — Ph.D., Natural Resource Science and Management (Environmental Science Policy and Management)

Bruce Vondracek

Dickson Atuke, Ph.D. (completed 2008)-Conservation Biology Program (Fisheries and Aquatic Biology track)
Bethany Blick, M.S.-Water Resources Science Program
Rebecca Bronk, M.S. (completed 2008)-Conservation Biology Program (Fisheries and Aquatic Biology track)
Veronica Bullock, M.S.-Conservation Biology Program (Fisheries and Aquatic Biology track)
Joel Chirhart, M.S.-Water Resources Science Program
Christine Dolph, Ph.D. (completed 2008)-Water Resources Science Program
David Huff, Ph.D.-Conservation Biology Program (Fisheries and Aquatic Biology track)
Matt Kocian, M.S.-Conservation Biology Program (Fisheries and Aquatic Biology track)
John Loomis, M.S. (completed 2008)-Water Resources Science Program
Kara Raymond, M.S.-Water Resources Science Program
Kathrine Ruddick, M.S.-Conservation Biology Program (Fisheries and Aquatic Biology track)

RESEARCH SUPERVISION

David E. Andersen

Jason Bruggeman, Research Fellow, Department of Fisheries, Wildlife, and Conservation Biology, June 2007-present

David C. Fulton

Susan A. Schroeder, Research Fellow, Department of Fisheries, Wildlife and Conservation Biology, October 2002-present.

Raintry Salk, Research Fellow, Department of Fisheries, Wildlife and Conservation Biology, July 2008-present.

Bruce Vondracek

Christopher J. Chizinski, Research Fellow, Department of Fisheries, Wildlife and Conservation Biology, October 2007-present.

UNDERGRADUATE MENTORING

No undergraduate research projects supported in 2008

SERVICE

David E. Andersen

- Member, *Eastern Prairie Population Canada Goose Committee of the Technical Section of the Mississippi Flyway Council*
- Associate Editor, *Proceedings of the 10th American Woodcock Symposium*

- Chair, *Awards Nomination Committee*, The Raptor Research Foundation, Inc.
- Session Moderator – 12th Annual Meeting of The Wildlife Society, Madison, Wisconsin
- Steering Committee Member, 1st Annual Boreal Hardwood Transition Zone Forest Bird Diversity Workshop. Cass Lake, Minnesota
- Steering Committee Member, 10th American Woodcock Symposium. Roscommon, Michigan
- Steering Committee Member, 2010 Midwest Fish and Wildlife Conference

Manuscript Reviews (2007/2008)

Journal of Raptor Research (2)
Journal of Wildlife Management (1)
American Midland Naturalist (1)
Auk (1)
Condor (1)

Proposal Reviews

National Science Foundation (1)
U.S. Department of Agriculture (1)

David C. Fulton

- President, Minnesota Chapter American Fisheries Society 2008-2009
- Member, Planning Committee, Pathways to Success: Integrating Human Dimensions into Fisheries and wildlife Management, Conference October 2008.

Manuscript Reviews (2007/2008)

Human Dimensions of Wildlife (2)
Environmental Management (2)
Human Dimensions text book John Hopkins Press
Urban Fishing Symposium - AFS (2)

Proposal Reviews

New York Sea Grant (1)

Bruce Vondracek

- Minnesota Chapter of the Society for Conservation Biology, Vice President
- North American Benthological Society, member, Science and Policy Committee
- Minnesota Chapter of the American Fisheries Society, Scholarship Committee, chair
- Equal Opportunity Section of the American Fisheries Society, Travel Awards Committee, member

Manuscript Reviews

Hydrobiologia (1)
North American Journal of Fisheries Management (1 + second review)
Journal of the North American Benthological Society (1)
Aquatic Ecology (1)
New Zealand Journal of Marine and Freshwater Research (1)

Book Chapter

The Water Environment of Cities, Derek Booth and Brian Bledsoe, "Streams and urbanization: a hydro-geomorphic perspective on impacts, mitigation, and restoration".

RESEARCH PROJECTS

Ongoing projects

Alternative deer management strategies in Minnesota state parks 2005-2007.

\$108,000. Funding: Minnesota DNR. Principal Investigator: David C. Fulton. PhD Student: Lou Cornicelli.

Status: Data collection completed for the first 3 seasons.

The Minnesota Department of Natural Resources (DNR) is conducting a research project to evaluate the effects of alternative harvest regulations on deer populations. The research is being conducted on selected permit areas and state parks. The regulations being tested include different methods of reducing harvest pressure on males while increasing harvest on females. The DNR is interested in ascertaining the level of acceptance Minnesota deer hunters have towards regulation changes. The purpose of this study is to determine hunter acceptance of several different management options. Specifically, hunters who participated in the special hunts will be asked about their hunting experience, number of animals seen and harvested, and their future intentions towards hunting. Hunters will be asked their attitudes toward all these different strategies and will also be asked how they feel about "party" hunting and if they are will to change that as well. A total of 3,600 deer hunters were contacted via a mail survey after the conclusion of each fall deer season, including all 1,600 hunters who participated in the special park hunts and a random sample of 2,000 hunters who participated in the early antlerless season using a mail survey with up to 4 total contacts.

Canada goose nesting ecology and habitat use in relation to snow geese at Cape Churchill, Manitoba (continued).

\$250,000. Funding: U.S. Geological Survey-Cooperative Research Units; Mississippi Flyway Council, EPP Canada Goose Committee of the Technical Section; the Wildlife Management Institute. Principal Investigator: David E. Andersen. Student: Matt Reiter (M.S. Wildlife Conservation, Ph.D. Wildlife Conservation).

Status: Project funded and field work began in spring 2004. Field work was extended through 2006 due to a poor reproductive year in 2004, and completed in 2006. M.S. thesis completed in 2006. Ph.D. data analysis and dissertation preparation underway.

For over thirty years, the breeding grounds of Eastern Prairie Population (EPP) Canada geese at Cape Churchill, Manitoba have been monitored as part of a larger research and management program for this flock. In the 1980s, monitoring efforts indicated that a rapidly increasing snow goose population might be displacing Canada geese from traditional brood-rearing and foraging areas by both reducing the extent of and altering available habitat. The objectives of this study are to document current levels of interaction between these two species with respect to nesting and brood-rearing behavior of Canada geese, ascertain whether increased snow goose abundance has had an adverse

impact on habitat quality, and if so, what are the implications for productivity of Canada geese. As an extension of a previous project, we will also focus on Canada goose-snow goose interactions across a range of historic conditions in the central Arctic, and assess existing survey data to describe and understand how factors identified as important at a local scale are translated across the breeding range. Field work was completed in summer 2006, and data analysis is currently underway. Matt Reiter defended his M.S. thesis in 2006 and is working on data analysis and writing for his Ph.D. dissertation.

Ecological and genetic characteristics of slimy sculpin in southeast Minnesota streams.

\$141,500. Funding: Minnesota Department of Natural Resources. Principal Investigator: Bruce Vondracek. Students: David Huff (Ph.D. Conservation Biology-Fisheries and Aquatic Biology track) and Rebecca Bronk (M.S. Conservation Biology-Fisheries and Aquatic Biology track).

Status: Second-year data collection currently underway.

The Departments of Natural Resources in Iowa, Minnesota, and Wisconsin have implemented a "reintroduction" programs for sculpin *Cottus* spp. in streams in the Driftless Area Ecoregion of each state. The goal of these projects is to increase the distribution of sculpin by re-establishing viable, self-sustaining populations in trout streams where native populations are presumed to have been present historically, but were extirpated and unable to recolonize (<http://www.dnr.state.mn.us/areas/fisheries/lanesboro/management.html>). This effort will restore an ecologically important species to these coldwater streams and provide an additional forage component to wild trout populations. Sculpin were successfully reintroduced to a southwest Wisconsin stream in the 1970s. However, the reintroduction programs were instituted with limited information about the ecological suitability of the streams selected for reintroduction. This study will investigate genetic characteristics, survival, prey availability, diet of slimy sculpin, and habitat of donor and recipient streams to determine characteristics of streams most amenable to establishing reintroduced populations and examine ecological exchangeability of sculpin.

Understanding the importance of weak-tie networks in complex human-environment systems: ecosocial feedback in multifunctional agriculture.

\$925,000 (\$120,00 to BCV). Funding: National Science Foundation. Principal Investigator: Bruce Vondracek. Student: Kara Raymond (M.S.-Water Resources Science Program)

Status: Funding began 1 September 2007, first field season completed.

In agriculture, 'multifunctionality' refers to production of a range of agricultural commodities and conservation of biodiversity and water quality. Multifunctional agriculture addresses a range of social and ecological challenges to sustainability. This project will be conducted by an interdisciplinary team to evaluate multifunctional agriculture as a coupled human-environment system driven by ecosocial feedback, weak-tie social networks, and multiple biophysical benefits. Weak-tie networks allow the shared perception of biophysical signals, communication, resource exchange, and collective action by individuals and groups to generate ecological benefits and increase the size and resource base of social networks. Work will occur in New York, Pennsylvania, and Wisconsin, areas that differ in adoption of rotational grazing (RG). The project will examine individual and group behavior and development of social networks, and assess the biophysical effects on terrestrial and aquatic systems at farm and

landscape scales. Our portion of the project will address stream channel characteristics and aquatic macroinvertebrate communities in relation to RG compared with continuously grazed pastures. The proposed research will help identify both opportunities and barriers affecting development of a sustainable bioeconomy based on multifunctional agriculture.

Evaluating riparian timber harvesting guidelines: phase 3.

\$400,000 (\$121,900 to BCV) Funding: Legislative Citizens Committee on Minnesota Resources. Principal Investigator: Bruce Vondracek. Student: Eric Merten (Ph.D.-Water Resources Science Program) and Postdoctoral Researcher: Christopher Chizinski.

Status: Funding began 1 July 2007, field data collection is complete, manuscripts in preparation.

Riparian guidelines have been the most controversial of the seven components of Minnesota's forest management guidelines. Research addressing the long-term effectiveness of riparian guidelines is critical to resolving riparian management conflicts, informing the ongoing revisions of the Minnesota Forest Resources Council's (MFRC) riparian guidelines, and sustaining Minnesota's forest resources. This project will (1) evaluate the long-term effectiveness of Minnesota's riparian guidelines on 8 northern Minnesota sites and at 12 previously established sites in the Pokegama Creek basin, (2) begin to combine and synthesize data from the multiple study components through a "meta-analysis," and (3) provide information to natural resource professionals about riparian zone management. Specifically, we will (1) evaluate the effects of riparian harvest on stream ecosystem functioning using measures of invertebrate biomass, in-stream leaf and wood decomposition rates, in-stream habitat, and food web analyses and (2) evaluate the effects of harvest treatments through time on both the terrestrial (birds, trees and understory woody and herbaceous species) and aquatic habitat components as well as changes of terrestrial and aquatic communities (fish and invertebrate) in a meta-analysis. We will evaluate the response variables collected in previous years on the 8 northern Minnesota and the 12 Pokegama Creek study sites.

Predicting large wood transport and effects on stream geomorphology in northern Minnesota streams.

\$64,000. Funding: Minnesota Department of Natural Resources. Principal Investigator: Bruce Vondracek. Student: Eric Merten (Ph.D.-Water Resources Science Program)

Status: Funding began 1 June 2007, second field season completed.

Large wood performs many important ecosystem functions in streams, including diversifying instream flow environments (e.g., plunge pools, and backwater habitat), creating overhead cover for fish, and providing a stable substrate for invertebrates and periphyton. Few instream studies of large wood dynamics have been completed in the Midwest, rather the majority of studies have been from mountainous areas with steeper gradients and narrower floodplains. We will use individual logs to investigate instream wood dynamics in streams flowing through second-growth forest to improve our understanding of instream wood processes in the Midwest. We will relate mobilization and retention of individual pieces to geomorphic conditions and piece characteristics. We hypothesize that shorter, smaller, and more buoyant pieces will be mobilized more readily than large dense pieces, and that channels that are steeper, wider, and more

entrenched will retain less wood than narrow, shallow, nonentrenched channels. Information gained from this study will be used to improve riparian management policies, wood removal regulations, and stream restoration practices.

Development of an ecological assessment method for Minnesota lakes.

\$78,000. Funding: Minnesota Department of Natural Resources. Principal Investigator: Bruce Vondracek. Student: Marcus Beck (M.S. Conservation Biology, Fisheries and Aquatic Biology track)

Status: Funding began 1 September 2007, interim report submitted March 2008.

The Minnesota Pollution Control Agency has encouraged the Department of Natural Resources to identify and develop two lake health indicators that could be used to assess whether Minnesota lakes are impaired as part of the Minnesota Legislature's Clean Water Legacy Initiative to facilitate the implementation of the Total Maximum Daily Load process mandated by the Clean Water Act. Our goal is to evaluate which indicators of lake health should be used for assessing the ecological integrity of lakes in Minnesota, focusing on an indicator that will complement the fish index of biological integrity (fish IBI) that has developed. Our objectives are to (1) review the existing indicators of lake health that have been used in temperate lakes, (2) use existing data within Minnesota to evaluate the applicability and robustness of existing measures of lake health, (3) prioritize approaches across the gradient of Minnesota lake types and identify data gaps, and (4) identify an approach to complement the fish IBI method, and recommend a general framework for its use in Minnesota.

Empowering water quality decisions: reducing uncertainty and bounding variability of stream ecosystem indicators.

\$278,069. Funding: Minnesota Department of Natural Resources. Principal Investigator: Bruce Vondracek. Student: Christy Dolph (Ph.D.-Water Resources Science Program)

Status: Funding began 1 June 2007, interim report submitted March 2008, M.S. Thesis defense April 2008, Ph.D. program began following successful completion of M.S.

Impaired waters and the Total Maximum Daily Load approach are central drivers to water quality management mandated by the Clean Water Act. Water quality and ecological integrity vary across a gradient of human disturbance, but assessing how ecological integrity is affected by human disturbance is complex and requires robust indicators of ecological health. Indicators are used to quantify stream ecosystem integrity; however, uncertainty and variability of those indicators are poorly understood. We will conduct research that will aid Minnesota regulatory agencies in reducing the uncertainty and variability of indicators of stream ecosystem integrity to allow managers to make decisions based on scientific knowledge and be more defensible than current decisions. We have three objectives; (1) quantify the uncertainty surrounding stream health indicators, (2) evaluate the variability of indicators of stream health at different spatial scales, and (3) deconstruct stream health indices to understand which index metrics contribute most to uncertainty and variability at different spatial scales. Our project will advance management of stream ecological resources by aiding accurate identification of impaired streams, using existing data to understand the history of stream ecosystem integrity, and increasing efficiency with which stream ecosystem integrity is assessed and monitored.

Geographical Information Systems techniques to channel slope delineation in Minnesota.

\$17,000. Funding: U.S. Geological Survey. Principal Investigator: Bruce Vondracek. Student: Matt Kocian (M.S. Conservation Biology-Fisheries and Aquatic Biology track).

Status: Third field season underway.

Our goal is to evaluate automated methods to estimate channel gradient, and to develop estimates of stream power and flood discharge and frequency for unregulated streams within Minnesota. Previous studies have demonstrated relationships between the gradient of stream channels and fish and macroinvertebrate assemblages. Twenty-one of 35 habitat features in Wyoming streams were related to channel gradient. Although field techniques to measure channel gradient are standardized, several techniques to estimate stream gradient using a GIS exist, but a standard technique has not been chosen. The objectives of this study are to (1) determine a method for measuring channel gradient that provides similar estimates to field measurements with standard techniques, (2) identify GIS method(s) that provide similar estimates to measurements made in the field, and (3) develop estimates of flood discharges using regression equations based on our field and GIS methods.

Habitat use of post-fledging forest-nesting songbirds in northern hardwood-coniferous forests in northern Minnesota.

\$225,000. U.S. Geological Survey (Science Support Initiative), U.S. Fish and Wildlife Service, U.S. Forest Service. Principal Investigator: David E. Andersen. Student: Henry Streby, Natural Resources Science and Management (Wildlife Ecology and Conservation).

Status: Pilot season (2005) and 3 field seasons (2006, 2007, and 2008) completed.

Compared to use of nesting habitat, habitat use by forest-nesting songbirds following fledging is relatively poorly understood. Recent studies based on point counts and mist-netting, and monitoring movement of fledglings via radio-telemetry, suggest that for at least some species of forest-nesting songbirds, habitat use post-fledging can be quite different from breeding-habitat use. To date, information regarding habitat use following fledging for forest-nesting birds is limited to a few studies from eastern (Virginia and West Virginia) and southern (Missouri) deciduous forests, and from only a few species of forest-nesting birds. No published information regarding post-fledging habitat use exists for northern hardwood-coniferous forest birds in the western Great Lakes region. Forest-management plans that incorporate considerations for forest-nesting birds generally do not consider habitat use following fledging. A more complete understanding of habitat use by forest-nesting birds in northern hardwood-coniferous forests would provide the basis for better incorporating considerations for forest-nesting birds in forest management in the western Great Lakes region.

Our objectives include; (1) determine what species of forest-nesting birds (both adults and fledglings) use a range of habitats from early successional to mature forest during the post-fledging period, and (2) document post-fledging movements and habitat use of selected forest-nesting species in northern hardwood-coniferous forests in northern Minnesota. In 2006, we monitored post-fledging habitat use of select forest-nesting songbirds with nest searching and radio telemetry, and increased (from 2005) sampling of early successional (clearcut) habitats associated with mature upland forest in the

Chippewa National Forest in north-central Minnesota. We established 3 study locations, each containing substantial continuous mature mixed deciduous and conifer forest and clearcut habitats of at least 2 age ranges (1-5 and 6 – 10 years since harvest). In mature forest, we monitored nests of 3 target species: ovenbird (*Seiurus aurocapillus*), hermit thrush (*Catharus guttatus*), and wood thrush (*Hylocichla mustelina*) nests, and attached radio transmitters to ovenbird, wood thrush, and hermit thrush nestlings. We tracked ovenbird, wood thrush, and hermit thrush fledglings in habitat different from their nesting habitat on approximately 30 – 40% of days tracked. We sampled regenerating aspen (*Populus* spp.) clearcuts of 2 ages twice weekly using mist nets from early June through late August and captured approximately 1,200 – 1,500 birds annually. Hatch-year birds of species associated with nesting in mature forest habitats used different portions of 6 – 10-year-old clearcuts similarly, while in younger clearcuts, they were captured more frequently farther from than near an edge. Lab analyses are currently being conducted on invertebrate samples and all project data have been collected.

Human Dimensions Research Fellow

\$305,000 Funding: Minnesota Department of Natural Resources. Principal Investigator: David C. Fulton. Research Fellow: Susan Schroeder

Status: Ongoing; completed study on lead shot use and ban in the Minnesota farmland zone and initiated study on walleye.

Currently, there is a significant demand from the Minnesota Department of Natural Resources (DNR) to conduct studies focused on the human dimensions aspects of fisheries, wildlife, and ecological management issues. While many of these studies provide funding opportunities for graduate students including graduate theses, creation of a Human Dimensions (HD) Research Fellow position at the Minnesota Cooperative Fish and Wildlife Research Unit provides a way to collect additional information more cost effectively. In addition, this position could help ensure that data are collected in a consistent fashion across activities and issues and over multiple years. Doing so facilitates the development of a human dimensions information database that is comparable across issues and over time. Such a database is an important cornerstone in creating an effective human dimensions research partnership between the Minnesota DNR and the University of Minnesota, through the Minnesota Cooperative Fish and Wildlife Research Unit.

Synthesizing human dimensions information on Minnesota anglers to frame an outcomes-based management system for fishing in Minnesota.

\$65,000. Funding: Minnesota Department of Natural Resources. Principal Investigator: David Fulton. Research Fellow: Raintry Salk.

Status: Manuscripts based on existing data are being framed and drafted beginning with Southeast Minnesota trout management.

This study synthesizes existing information from Minnesota anglers' preference for activities, experiences and settings to develop an outcomes-based management framework in diverse fishing settings in Minnesota. This information will be used to design a statewide recreational fishery management and monitoring system for evaluating the quality of fishing experiences in Minnesota. This study will focus on analysis of

existing data collected during the past 7 years from several angler surveys and the Electronic Licensing System database.

American woodcock singing-ground surveys in the western Great Lakes region: assessment of trends in woodcock counts, forest cover types along survey routes, and landscape cover type composition.

\$153,347. Funding: U.S. Fish and Wildlife Service (Webless Migratory Game Bird Research Program), Minnesota Department of Natural Resources, Wisconsin Department of Natural Resources, Woodcock Minnesota, Minnesota Cooperative Fish and Wildlife Research Unit. Principal Investigator: David E. Andersen. M.S. Student: Matt Nelson.

Status: Graduate student started data collection and degree program in summer 2007 and is currently working on vegetation classification and delineation along survey routes in Wisconsin and Minnesota.

Our overall objective is to better understand the relationship(s) between changes in counts of woodcock on Singing-ground Surveys in Minnesota and Wisconsin and forest land cover. We proposed to assess patterns in annual counts of woodcock along existing survey routes, assess changes in time in land cover types along these routes, relate temporal changes in woodcock counts to changes in land cover composition, and compare current cover type composition along routes to current landscape cover type composition. If possible, we will also compare past cover type composition along survey routes to landscape cover composition. Specific project objectives are as follows:

- (1) Assess patterns in annual counts of American woodcock along survey routes in Minnesota and Wisconsin,
- (2) Assess changes through time in land cover types along Singing-ground Survey routes in Minnesota and Wisconsin,
- (3) Relate temporal changes in land cover types to woodcock counts,
- (4) Compare current cover type composition along routes to current landscape composition, and if possible, compare past cover type composition along routes to past landscape composition.

Bioregional monitoring for northern goshawks in the western Great Lakes.

\$120,000. Funding: U.S. Forest Service. Principal Investigator: David E. Andersen. Postdoc: Jason Bruggeman. \$3,000 supplement (Wisconsin Department of Natural Resources).

Status: Postdoctoral research associate began data summary and survey protocol development in 2007. Surveys conducted in Minnesota, Wisconsin, and Michigan in 2008.

Relatively little is known regarding northern goshawk abundance, distribution, and population trend in the western Great Lakes region. Following a regional goshawk meeting in Wisconsin in 2004, there was consensus among natural resource agencies and researchers that development of a regional biomonitoring program for northern goshawks was desirable, and the U.S. Forest Service provided funding to support a postdoc to develop a sampling program and compile necessary landcover information to conduct such a program. In April 2007, a second stakeholder meeting was convened in northern Wisconsin, and we hired a postdoctoral research associate to begin data assessment and

protocol development. A regional survey protocol was developed and provided to cooperators in September 2007. Additional funding was secured in early 2008 to conduct surveys in a portion of the region in spring and summer 2008, and these surveys were completed and resulting data are currently being analyzed.

Factors affecting detection of American woodcock on Singing-ground Surveys.

\$155,000. Funding: U.S. Fish and Wildlife Service (Migratory Bird Management Office).

Principal Investigator: David E. Andersen, M.S. Student: Stefanie Bergh.

Status: M.S. student selected in spring 2008 and pilot study conducted as part of ongoing work with private landowners in Pine County, Minnesota. Project cooperators meeting convened summer 2008.

The Singing-ground Survey is the primary means by which American woodcock population trends are monitored in North America. This study is designed to assess factors that influence detection of woodcock on this survey, and to estimate woodcock detectability, and what factors influence detectability. Objectives include:

- (1) Estimate detectability of woodcock using current sampling protocols, using repeated occupancy sampling of a subsample of routes, assessing detectability based on video or telemetry to refine conditions under which woodcock are detectable, double observer assessment of detectability and observer variability, and/or repeating survey routes to assess detection probability through time, and
- (2) Compare woodcock density along Singing-ground Survey routes with randomly located experimental routes in adjacent areas to directly assess whether counts on existing routes adequately represent the larger landscape.

Understanding human behaviors concerning lake shoreline management

\$79,000 Funding: Minnesota Department of Natural Resources. Principal Investigator: David C. Fulton. Ph.D. Student: Ed Rudberg.

Status: Visual field survey data collected and focus groups completed.

The purpose of this study is to understand the values, attitudes, norms and beliefs that lead to household behaviors about how privately held residential land will be managed around lakes. Ultimately, understanding the psychological and social factors that drive these decisions can help us design information and education efforts to decrease undesirable behaviors and increase desirable behaviors such as restoration of native vegetation on residential properties.

New projects

No new projects initiated in 2008.

Ongoing projects – Cooperating Faculty

Ammonia, nitrite and nitrate toxicity to the Topeka shiner (*Notropis topeka*)

\$56,638. U.S. Fish and Wildlife Service. Principal Investigator: Ira Adelman. Staff: Luke Kusilek

Status: Laboratory toxicity testing has been completed. The final report is being drafted.

The objective of this study is to determine the concentrations of ammonia, nitrite, and nitrate that cause adverse effects on survival, growth and development of Topeka shiners.

A series of toxicity tests were conducted, in accordance with ASTM guidelines in which Topeka shiners and fathead minnows were exposed to three toxicants (ammonia, nitrite, and nitrate) as separate tests.

Concentrations of nitrogen chemicals in Topeka shiner Critical Habitat may be of sufficient magnitude to either directly or indirectly adversely affect native minnows. However, the specific concentrations at which the various nitrogen forms adversely affect the Topeka shiner compared to other native minnows are not known because chemical toxicity data are lacking for this endangered species. Regulatory agencies often need species-specific sensitivities of the Topeka shiner to different nitrogen forms. To date, information that is available for closely related species such as other native shiners or minnows that may or may not represent the sensitivity of the Topeka shiner is being used, but this information may not be protective of Topeka shiners. Therefore, this project will determine the concentrations of ammonia, nitrite, and nitrate that cause adverse effects on survival, growth and development of Topeka shiners. With the toxicity tests now completed, the data are being prepared in the final report to indicate “safe” concentrations for Topeka shiners.

Genetic determination of the boundary between northern and California spotted owls.

\$21,710. Funding: U.S. Fish and Wildlife Service. Principal Investigator: R.J. Gutiérrez.

Status: Agreement supporting this project processed and in place. First year of field (2007) work was not successful due to difficulty in accessing private land where most of the owls are found in this area. The primary private company's head biologist was unable to assist in facilitating access to private land because of a serious illness. We delayed data collection until 2008. In 2008, we were successful in gaining access to private land after 13 months of negotiation with landowners. However, timing of 2008 surveys was delayed because of these negotiations, which resulted in only one field trip to locate and capture birds. In addition, the unusual abundance and extent of wildfires in California during the summer of 2008 also had a major impact on our ability to access areas for owl surveys. Thus far, we have captured 5 owls and need at least 10 more if located in the proper places to successfully complete the study.

Understanding the boundaries between populations of northern and California spotted owls is important for management and conservation of the species. Morphometric characteristics have proved unreliable in delineating subspecies, yet the subspecies boundaries have been placed arbitrarily at the Pit River in northern California. We know

the boundary between subspecies occurs somewhere in northern California based on previous DNA sampling 50 miles north and 40 miles south of the Pit River. Currently, there are no relevant samples from the area between Mt. Shasta and Mt. Lassen in north-central California that could be used to delineate the precise range boundary of the subspecies. The objectives of this project are to evaluate whether either a discrete boundary or a cline exists in the vicinity of the Pit River in northeastern California based on analysis of DNA and predictions of cline theory. We have captured 5 birds thus far, but will extend this project for another year to allow capture of owls in 2009. We believe the difficulties with access to private land have been overcome through a long process of multiple requests so we are optimistic about the successful completion of this project in 2009.

Long-term monitoring of colonial waterbird populations in the Great Lakes: improving the scientific basis for conservation and management.

\$314,853. Funding: U.S. Fish and Wildlife Service. Principal Investigator: Francesca Cuthbert. Student:

Status: Project initiated in 2007. First and second field seasons completed.

The U.S. Fish and Wildlife Service and Canadian Wildlife Service have conducted three coordinated Great Lakes-wide surveys of breeding colonial waterbirds, incorporating a total count of all nests to estimate population sizes and distributions. Results from these efforts provided an important population inventory and documented significant population increases in some species and recent colonizations by American white pelicans and great black-backed gulls. Surveys also reported species with small populations and identified important breeding habitat for colonial waterbirds in the Great Lakes. These efforts provided the first comprehensive perspective on population trends over a 20-year period and included information on historically stable colony sites, species-specific habitat requirements and issues of conservation and management concern. However, because the survey is so labor intensive and expensive, it is conducted very infrequently (once every 10 years) and therefore has minimal value as a trend indicator. The 10-year interval between surveys does not allow rapid detection of changes in population trends and/or shifts in distribution, nor is it possible to evaluate population trends with high confidence from the limited data points produced.

In 2007, the 4th decadal survey effort was initiated and incorporates new, less-labor intensive methodologies. The survey is being undertaken on a lake-by-lake basis, incorporating total counts of all birds on an individual water body within the same year. The goals of the project are to inventory (determine current distribution and abundance of) U.S. Great Lakes colonial waterbirds and identify sites that can be monitored, perhaps at 2-5 year intervals (depending on species), to enable trend detection and better inform management and conservation decisions. In the context of this large-scale inventory, the specific objectives of this research are to (1) estimate regional population size, breeding colony size, and location of colonial waterbirds in the U.S. portion of the Great Lakes ecosystem and coordinate this effort with the Canadian Wildlife Service for a Great Lakes-wide estimate, (2) evaluate inventory methodology by comparing population estimates obtained from the ground and aerial photos (both total and sample plots) to assess accuracy of both methods to estimate nesting pairs for multiple species, (3) estimate and apply habitat-based detection rates for species at selected sites to improve survey accuracy, (4) determine how numbers of breeding birds at select sites change over

a season and compare these data to the traditional one-season count, (5) compare results of this census to previous similar efforts in the Great Lakes to assess changes in population numbers and colony distributions, and (6) identify the most important sites to monitor on a frequent basis in the future for detecting population trends by (a) utilizing and possibly refining the existing prioritization method, and (b) evaluating management and species-specific monitoring needs.

New projects – Cooperating Faculty

No new projects initiated in 2008.

Completed Research

Comparison of effects on stream habitat and fish nine years after harvest treatments.

\$48,450. Funding: Minnesota Department of Natural Resources, U.S. Forest Service, and the National Council for Air and Stream Improvement. Principal Investigator: Bruce Vondracek. Co-Principal Investigator: Ray Newman. Student: Eric Merten (Ph.D. Water Resources Science)

A study “Evaluating riparian area dynamics, management alternatives and impacts of harvest practices” was initiated in 1997. Several variables were examined including; plant community composition and diversity, tree regeneration, song bird communities, blowdown in riparian management areas, fish communities, and stream habitat. The area is now in its ninth year since harvest. We visited project study sites to collect data from the ninth year post-harvest time period in summer 2006. Our portion of a larger project with collaborators from the U. S. Forest Service and The Natural Resources Research Institute examined fish populations and stream channel characteristics. This information is required to assess long-term impacts and recovery from forest management activities. This study will serve as the basis for longer term assessment of the effects of riparian harvest and provide information about the ecology of forest streams and will be used directly by the Minnesota Forest Resources Council to develop forest management policy in Minnesota.

Effects of riparian forest harvest on instream habitat and fish and invertebrate

communities. \$428,878. Funding: Minnesota Department of Natural Resources, Legislative Committee for Minnesota Resources, and Water Resources Center. Principal Investigator: Bruce Vondracek. Co-Principal Investigator: Raymond M. Newman. Students: Dickson Atuke and Nicholas Schlessner

This project examined the effectiveness of guidelines to protect forested riparian areas at a site level. Guidelines developed in Minnesota in 1999 recommended timber harvest in riparian areas. This project was part of a larger effort with the U. S. Forest Service and the Natural Resources Research Institute. Our interdisciplinary team evaluated effects of riparian forest harvest on water quality, fish, invertebrates, and stream morphology across three riparian harvest treatments (none, low, and intermediate) in association with unharvested (riparian and upland) control sites and sites with no harvest in the riparian zone adjacent to upland clearcuts. Our time frame was 1 year of pre-harvest (2003) and 3 years of post-harvest (2004-2006). We found significant variation among years in habitat scores and macroinvertebrate assemblages and differences within and among sites in fish

species composition and abundance. Continued monitoring will be required before we can fully assess the effects of riparian harvest. This study serves as the basis for longer term assessment of the effects of riparian harvest and provides information about the ecology of forest streams that will be used by the Minnesota Forest Resources Council to develop forest management policy in Minnesota.

Mortality of walleye caught in live-release tournaments: assessment, reduction, and determination of acceptable levels.

\$259,144. Funding: Minnesota Department of Natural Resources. Principal Investigator: Bruce Vondracek. Co-Principal Investigator: David Fulton. Students: John Loomis (M.S. Conservation Biology-Fisheries and Aquatic Biology track) and Jeremy Bruskotter (Ph.D. Natural Resource Science and Management).

Research on black bass tournaments indicates that fish die from hook and handling injury, bacterial disease, or undesirable conditions in boat livewells or during weigh-in and release. Most mortality is due to poor livewell and tournament handling conditions. Numerous studies of black bass tournaments indicate that total mortality has averaged 28% during the past two decades. Assessments of walleye tournaments suggest mortality is substantially higher although fewer studies have been completed for walleye. Three issues must be addressed for the conservation of high-quality walleye fisheries in light of walleye tournaments; (1) accurate estimates of total mortality in live-release tournaments, (2) development and evaluation of procedures to maximize survival of walleye in live-release tournaments, and (3) determine levels of mortality that are biologically and socially acceptable. Our objectives were; (1) determine accurate estimates of total mortality in 15 walleye tournaments, (2) develop and evaluate procedures to maximize the survival of walleye caught in live-release tournaments, (3) determine potential effects of tournament mortality on walleye populations using population models, and (4) determine levels of mortality for tournaments that are socially acceptable. This research provided information useful to maximize survival of tournament-caught walleye and the effective integration of walleye tournaments in fishery management by tournament organizers and fishery agencies.

Features of the Farm Bill that influence breeding birds.

\$27,553. Funding: U.S. Geological Survey, Northern Prairie Wildlife Research Center. Principal Investigator: David E. Andersen. Research Associate: Maiken Winter

Information collected in this study has the potential to help guide future directions of Farm Bill and other conservation programs by addressing critical questions related to how breeding birds are influenced by a variety of factors. The goal of the work described here was to exploit extant data to address those questions.

Specific objectives were:

- (1) to determine how densities of breeding birds in CRP fields are influenced by vegetational metrics, such as the ratio of forbs to grasses;
- (2) to determine how densities of breeding birds in CRP fields are influenced by the relative composition of native versus introduced species; and to determine how densities of breeding birds in the upland portions of CRP fields are influenced by the fraction of a CRP field that is wetland.

We studied breeding-bird use of CRP fields in 5 north-central states during 2001-2003,

involving 128 fields planted either with primarily native or introduced species. Both planting types supported large populations of some grassland bird species, such as bobolinks and savannah and grasshopper sparrows. Some species of conservation concern either were not detected in either planting type (such as Sprague's pipits, greater prairie chicken) or occurred in very low numbers (Baird's sparrow, dickcissel). The only species of conservation concern that occurred in high numbers in CRP fields were grasshopper sparrows. There were 2 major differences in bird communities between native and introduced fields; (1) several grassland birds of conservation concern did not occur in introduced plantings (chestnut-collared longspurs, Henslow's sparrows, marbled godwit, willet, sharp-tailed sparrow); and (2) the only grassland bird species that preferred introduced to native plantings were bobolinks and brown-headed cowbirds. These patterns were consistent among regions and years. Native plantings had lower and less dense vegetation with more litter – a feature that was preferred by species typical of mixed-and short-grass prairie. Therefore, native plantings will be more valuable in the western portion of the Great Plains. In contrast, introduced plantings should be valuable in the eastern regions as long as the fields are allowed to develop litter extensive enough to provide shelter and nesting places.

Stream classification for TMDL assessment using a dimensionless, reference reach approach. \$898,592. Funding: US Environmental Protection Agency and Minnesota Pollution Control Agency. Principal Investigators: Bruce Vondracek, James A. Perry, Bruce Wilson, John Nieber.

Clean rivers, lakes, and streams consistently rank foremost among environmental priorities for citizens of Minnesota. Recent research has emphasized the importance of using physical, chemical, and biological indicators of stream health for diagnosing impaired watersheds and their receiving water bodies. A multidisciplinary team of biologists and hydrologists from the University of Minnesota and the Minnesota Pollution Control Agency (MPCA) is developing a regional stream classification system to facilitate Total Maximum Daily Load (TMDL) assessment of impaired waters in Minnesota. The classification will use regional reference reaches to account for complex factors related to precipitation, land use, soil, and geology. Objectives are: (1) investigate the relationship between indicators of stream health and local characteristics in 4 ecoregions, (2) develop and evaluate dimensionless curves using reference reach values for stream classification and TMDL assessment, and (3) test a stream classification system using the prediction intervals of the dimensionless curves. An independent data set will be used for validating dimensionless curves. This approach is well suited to affect changes in land use and other watershed practices to address nonpoint source pollution. The classification system will be used by the MPCA to prioritize TMDL programs.

Completed Research – Cooperating faculty

An evaluation of storm-water management in a watershed of the Minnesota Valley National Wildlife Refuge.

\$72,823 U.S. Fish and Wildlife Service, Region 3. Principal Investigator: Bruce Wilson. Student: Brian Ash (M.S., Biosystems and Agricultural Engineering).

The Minnesota Valley National Wildlife Refuge provides valuable habitat for waterfowl, fish, and other wildlife species threatened by commercial and industrial development. Possible contaminants contained in the storm water discharged into the Refuge are a

potential pollution problem. An instrumentation system was designed to study contaminants in stormwater from different land use activities in the City of Bloomington. Seven monitoring stations were initially established in the watershed. Because of instrumentation problems, the number of monitoring station was reduced to 5. The study was largely focused on gathering samples from rainfall events. Nonetheless, snowmelt samples were gathered in 2005 and 2006. Grab samples were also taken from a seep location in 2004, 2005 and 2006.

An analysis of runoff depth showed the expected trend of increasing runoff depth with storm depth. Considerable scatter in observed concentrations and load-per-area was found in analyzing the water quality data from rainfall events. Nonetheless, significantly different mean concentrations with location in the watershed were found using one-way ANOVA for potential contaminants of chromium, lead, manganese, nickel, phosphorus, and total suspended solids. The site at Glenview Lane had consistently the greatest concentrations of potential contaminants. Chloride concentrations for snowmelt events were larger than those measured from rainfall events. Relatively large concentrations of chloride, magnesium, and barium were found at the seep site.

Storm water is treated by Pond C before discharging into the Refuge. Two different methods were used to estimate the removal of contaminants by Pond C, one using a mass definition of trap efficiency and the other using the average influent and effluent concentration. The two different methods gave similar results for many of the chemicals including total suspended solids, arsenic, lead, and barium. For example, the trap efficiency of total suspended solids was 68% using the mass definition and 75% using the concentration definition. The trap efficiencies for barium, chloride, and magnesium were negative, corresponding to more mass leaving than entering the pond. These results were not surprising given the relatively large concentrations in snowmelt and/or groundwater sources that were not included in the computations. The removal of contaminants by detention ponds is storm dependent. No large return events occurred during the study period. Therefore we were unable to assess the possible impact of a large runoff event on the effectiveness of Pond C.

The study also examined the impact of changes in the design of Pond C using the BASIN simulation model. The accuracy of the input parameters to characterize pond geometry and elevation discharge, as well as the hydraulic algorithms, was evaluated using an observed event from 6 – 10 June 2004. The BASIN simulated outflow rates are in good agreement with those observed. The BASIN model was used to evaluate the performance of Pond C for 3 different storm events (1 inch, 2 inch, and 6 inch) and for the existing and proposed pond capacity. The change in trap efficiency from the existing to proposed pond capacity increased by roughly 10% for the one-inch and 6.5% for the six-inch storm.

A direct comparison of these results to those done as part of the Storm Water Treatment Feasibility Study for the City of Bloomington is difficult. Nonetheless, the predicted trap efficiencies from the Feasibility Study are generally in reasonable agreement with those obtained from the BASIN model. A noteworthy exception is that the Feasibility Study predicted a change in trap efficiencies from existing to proposed conditions that was approximately twice as large as obtained from the BASIN model. Predicted effluent concentrations from the 2 approaches were considerably different. Results from BASIN simulations predicted more than twice the sediment mass will be discharged from Pond C

than that obtained from the Feasibility study. This difference was largely the consequence of using larger influent concentrations in the BASIN simulations. The influent concentrations for the BASIN simulations were obtained from the data collected as part of the project.

Estimation and evaluation of demographic parameters required for recovery of the endangered Great Lakes piping plover population.

\$26,125. U.S. Geological Survey, Science Support Initiative. Principal Investigator: Francesca Cuthbert. Student: Erin Roche.

The piping plover (*Charadrius melodus*) is a federally endangered migratory shorebird endemic to the Great Lakes, Great Plains, and Atlantic Coast of North America. Piping plovers nested historically along the shoreline of all the Great Lakes and were once considered locally common throughout the region. Due to loss of breeding sites to development and increased use of plover habitat by humans, the population dropped to < 31 breeding pairs in Michigan by 1979. By 1986, when the Great Lakes population was listed as federally endangered under the Endangered Species Act, only 17 pairs remained. In 2000, a population viability analysis of all piping plover populations projected the Great Lakes population would decline to eventual extirpation. Since 2000, the Great Lakes population has more than doubled, increasing to an estimated >50 breeding pairs. The discrepancy between model projections and observed population growth necessitates re-evaluation of the demographic parameters necessary for population recovery.

We employed 2 single-population stochastic models to project the viability of this population over 20 and 50 year periods. Our goals were to:

- Clarify assumptions about current demographic parameters of Great Lakes piping plovers (e.g., age of first breeding, age specific survival).
- Refine proposed reproductive success estimates required to meet recovery goals established in the 2003 Great Lakes piping plover recovery plan.
- Re-assess projected time-lines for population recovery utilizing recent demographic data and examine current recovery program management options (e.g., increasing reproductive success).
- Estimate genetic variability of the population using non-invasive inferential methods (pedigree analysis) derived from software models developed for management of small populations.

Results suggest that under current best-case scenarios the Great Lakes population will require a fledging success rate of ~ 2.5 chicks per nest to reach the target population size of 150 pairs in the next 20 years. Vital rate values necessary to achieve this goal fall within the range of rates observed in the Great Lakes population since 2000. The high level of uncertainty inherent to population viability analysis requires that any conservation plan for the Great Lakes piping plover population account for the potential effects of annual vital rate variation. Limiting the scope of population viability projections and conservation targets to <20 years would allow conservation managers of imperiled populations to better assess target vital rates and potential management strategies *in lieu* of current population trends.

Estimating detectability rates for colonial waterbirds in the U.S. Great Lakes.

\$22,290. U.S. Fish and Wildlife Service. Principal Investigator: Francesca Cuthbert. Student: Linda Wires.

The U.S. Fish and Wildlife Service (USFWS) and Canadian Wildlife Service (CWS) have conducted 3 Great Lakes-wide surveys of breeding colonial waterbirds, one every decade since the 1970s. The second 2 surveys were organized to produce a temporally coordinated database. Data from all 3 surveys are stored at the U.S. Geological Survey's National Bird Population Data Center at Patuxent Wildlife Research Center. This repository archives data on waterbirds throughout their ranges and was facilitated through the North American Waterbird Conservation Plan and the Waterbird Monitoring Partnership. It is publicly accessible and allows biologists to submit and retrieve data over the Internet. Data collected in future Great Lakes colonial waterbird surveys will be deposited there.

In preparation for the next binational survey (2007-09), a workshop was convened at LaCrosse, Wisconsin (as part of the 2000 Annual Meeting of the Waterbird Society) with USFWS Region 3 funding to identify ways to improve the accuracy of the Great Lakes survey and ability to detect colonial waterbird population trends. As a result of the workshop, we submitted a report to USFWS with the following recommendations for research/pilot studies:

- a) determine detection rates to assess accuracy of total nest counts
- b) develop and test species-specific census strategies for improving our ability to detect trends in Great Lakes colonial waterbird populations
- c) develop and test sampling designs for large colonies and compare their accuracy with total nest counts
- d) investigate the feasibility of censusing certain species/colonies using aerial photography.

This agreement provides funding to develop and evaluate methods to be used in the 2007 Binational Great Lakes Waterbird Survey to improve the accuracy of this effort. This work plan will focus on one of the recommendations developed at the 2000 LaCrosse workshop: estimation of nest detection rates.

We determined detection rates for double-crested cormorants, Caspian terns, ring-billed gulls, herring gulls, great blue herons, and black-crowned night-herons. In general, the most important variable was habitat. Birds nesting on the ground in little or no vegetation were detected at higher rates than those in trees or birds on the ground in dense vegetation. We have also determined under which conditions we can use aerial photographs to obtain accurate estimates of colonial nesting species. Ground nesters are easier to locate, identify, and count than tree nesters. The best estimates (as compared to ground counts) are obtained using photos to count cormorants because their black plumage contrasts well against lighter substrates. Estimates are more accurate for ground versus tree-nesting birds.

Ecology of Canada lynx (*Lynx canadensis*) in Minnesota

\$443,301. Funding: U.S. Department of Agriculture, Forest Service – Superior National Forest; U.S. Fish and Wildlife Service; U.S. Geological Survey, Northern Prairie Wildlife Research Center; Minnesota Department of Natural Resources. Principal Investigator: Ronald Moen – Natural Resources Research Institute, Center for Water and the Environment, University of Minnesota, Duluth. Students: Christopher Burdett (Ph.D., Conservation Biology), Nick McCann (M.S., Biology), Julie Palakovich (M.S., Biology), Brice Hanson (M.S., Integrative Biological Sciences).

Minnesota historically supported the largest lynx population in the Great Lakes region. It was thought that Canada lynx had been extirpated from Minnesota in the early 1990s, but videos, sightings, and DNA evidence documented the presence of Canada lynx in Minnesota while lynx were being listed as a Threatened Species under the Endangered Species Act in 2000. This project was undertaken to increase understanding of the (1) location, (2) distribution, (3) persistence, and (4) habitat use of Canada lynx in and near the Superior National Forest (SNF) in northeastern Minnesota. We captured and deployed radio telemetry collars on 33 Canada lynx and 3 bobcats. One major question we addressed is whether Canada lynx persist in Minnesota through a lynx-hare cycle. Monitoring radio-collared individuals over the next decade, observations, and genetic analysis will all provide supporting data on the question of persistence. VHF telemetry provides data on the distribution of Canada lynx in Minnesota. Genetic analysis of scat, hair, and tissue identifies individual Canada lynx, and also provides a baseline for mark-recapture estimates of abundance as well as persistence in future years. Habitat use is being evaluated primarily with GPS collars, over 15,000 locations have now been collected. GPS collar data are supplemented with snow-tracking in the winter months. The status of the major prey species of Canada lynx, snowshoe hare (*Lepus americanus*), is monitored with permanent plots established throughout the SNF. Plots were distributed based on stratified random, systematic, and selective site selection strategies. These methods collectively make it possible to greatly increase understanding of Canada lynx in Minnesota.

Further details on the Canada lynx project are available on the Lynx Project website at www.nrri.umn.edu/lynx. The website provides a history of the project, lists project goals and accomplishments, and has annual reports available for download. Lynx sightings can be reported to the Canada lynx hotline (800-234-0054 or lynx@nrri.umn.edu).